REPORT
OF THE
SUPERINTENDENT
OF THE
U.S. COAST SURVEY
FOR
1852.

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REPORT

OF

THE SUPERINTENDENT

OF THE

COAST SURVEY,

SHOWING

THE PROGRESS OF THE SURVEY

DURING

THE YEAR 1852.

WASHINGTON:
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1853.

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LIST OF ERRATA.

Page.	Line from Top.	Line from Bottom.	For	Read	
3	.....	3d.....	.....	.....	Dele "so."
24	.....	3d.....	the.....	three.	
28	.....	7th.....	position.....	portion.	
43	3d.....	.....	.....	.....	Dele "(Appendix No. 16.)"
			l'Outre.....	Loutre.....	Passim.
71	.....	.....	.....	.....	Appendix No. 1.—Change 1852–53 in heading, to 1851–52.
72	9th.....	.....	.....	.....	After "latitude" insert longitude.
78	25 & 26...	.....	.....	.....	Transfer Lieutenants Doty and Huger to "office" part of list.
82	3d.....	.....	.....	.....	After "Beaufort harbor" insert N. C.
101	.....	1st.....	Tatersh.....	Talo'osh	Passim.
104	.....	17th....	Farralones.....	Farallones	Do.
104	.....	13th....	Farralone.....	Farallon.....	Do.
105	3d.....	.....	Ana.....	Año.	
105	.....	14th....	Arquilla.....	Arguilla.	
115	11th.....	.....	the phenomenon	these.	
119	.....	25th....	depressed.....	decreased.	
119	.....	19th....	mark	mask.	
121	.....	8th.....	.....	.....	Insert *and* before E.
121	.....	.....	.....	.....	Passim. For A read (A), and for (E) read E.
137	.....	18th....	Eastern State..	Eastern city.	
137	.....	18th....	Seacore.....	Secor.	
139	.....	17th....	Sedwick	Sedgwick.	
148	.....	16th....	Washington....	Fort Washingt'n.	

32D CONGRESS, 2d Session. } [HO. OF REPS.] { EXECUTIVE, No. 64.

LETTER

FROM THE

SECRETARY OF THE TREASURY,

COMMUNICATING

A report of the Superintendent of the Coast Survey, showing the progress of that work during the year 1852.

MARCH 3, 1853.— Ordered to be printed, and that five thousand extra copies be printed—one thousand of which are for the use of the Coast Survey office.

TREASURY DEPARTMENT,
February 28, 1853.

SIR: I have the honor to submit, for the information of the House of Representatives, the accompanying report, made to the department by Professor A. D. Bache, Superintendent of the Coast Survey, showing the progress of said work during the year ending January 1, 1853.

All of which is respectfully submitted.

THOMAS CORWIN,
Secretary of the Treasury.

Hon. LINN BOYD,
Speaker of the House of Representatives.

REPORT.

COAST SURVEY OFFICE,
February 7, 1853.

SIR: I have the honor to present my report for the past year, in pursuance of the regulations of the department. It embraces generally an account of the field and hydrographic work of the survey up to the first of November, 1852, and of the office work to the first of January, 1853.

My report has been delayed in consequence of service in connexion with the commissions for reporting plans for the improvements of the James and Appomattox, the Cape Fear entrance, and the Savannah river.

For four years the regular progress of the survey has carried it, in its field work, hydrography, and office work, into all the States on the coasts of the Atlantic, Gulf of Mexico, and Pacific. The division of the coast into sections, the measurement of one or more base lines in each, the establishment of certain points astronomically, and the extension of a triangulation from the bases, permit the progress of the survey in the field to be as rapid as the means appropriated will warrant. The office work is adjusted so as to be as nearly as possible in harmony with the field work, presenting approximate results as soon as practicable after the determinations in the field, and the more finished ones, subsequently.

A mere glance at the progress sketches in the different sections of the work, and their comparison with those of a few years since, will show that essential advance has been made, and is every year making, towards completion. The survey of the third section (from Cape Henlopen to Cape Henry) may be taken as a type of this progress. The work there was commenced in 1842, and now the main and secondary triangulation of the Chesapeake bay and ocean coast are very nearly completed, the topography and hydrography have kept pace with the triangulation, and the survey of some of the rivers to the head of tide has been made. Some portions of the coast are more and others less favorable for our work than this one; but it may be stated, generally, that had similar means been applied for the same length of time to the other sections, the same result would have been reached. This division into sections, it will be recollected, was only sanctioned in 1846, and means were furnished to begin the work in different sections only, at different successive periods, by an increase of the appropriation. The results of the work so plainly showed that there was great economy in extending the scale of it, resulting from the division of field and office labor, and the division of labor in those departments severally, and the employment of the same field parties in

different parts of the Union, according to the season. Its extension was made into the fourth section (North Carolina) in 1845; into the eighth section (Alabama, Mississippi, and Louisiana) in 1844; into the fifth section (South Carolina and Georgia) in 1846; into the ninth section (Texas) in 1846; into the sixth section (Florida) in 1849. The office work necessarily increased with this extension, and has only within the past year, if yet, reached the full development furnished by the present scale of appropriation.

It will be observed that this provides for work in all the sections but the seventh, which comprises part of the coast of Florida. The reefs and keys of South Florida claimed precedence over the part of the coast embraced in the seventh section, but the time appears to have come when this section should be commenced. It is possible that in another year, means may be applicable for this purpose; and if not, I shall feel it to be my duty to press a special provision for it. The harbors of St. Mark's, Apalachicola, Pensacola, and St. Joseph's and St. Andrew's bays, are included in this section. The claims of this portion of the coast are set forth in the report of a general reconnaissance by Assistant F. H. Gerdes, extracts from which are given in Appendix No. 12.

The extension of the survey to the western coast was made in 1849; and though the results there are necessarily obtained at a considerably greater proportionate cost than those on the Atlantic and Gulf of Mexico, yet they are fully worth the expenditure, in view of the rapidly increasing navigation and commerce of that part of the United States. The navigation is by steam-vessels, in large numbers; and these hug the coast, making a knowledge of its capes, headlands, and harbors, of its dangers and facilities, of the utmost importance. The pecuniary loss sustained by the government from the wreck of one United States steamer at Point Conception was nearly equivalent to the cost of the survey for a year, even at the prices of that region. It is designed to continue the present scale of the work there until such a coast chart is had as was furnished of our eastern coast by Des Barres, with surveys of all the important harbors, and then to diminish it, advancing more slowly.

This plan of the work on both coasts has been fully sanctioned by successive administrations and by Congress. The danger to be avoided was the giving an extension beyond bounds, which might be considered reasonable in the anxiety to press the work forward. It is but proper to assume that the sanction so often given to the present scale of the work shows that this danger has not been incurred, and in the estimates for the field and office work for the next fiscal year I have confined myself within those limits.

The general reconnaissance of the Atlantic and Gulf coast which is now making in connexion with the statistics of the work already executed, will, in a few seasons, enable me to present a project for the completion of the survey in the several sections.

The publication of the observations made in the progress of the survey has been recommended by the highest scientific authority of the country, and in successive reports I have called attention to it as a desirable thing. It will secure the observations from loss and casualties which can now be but imperfectly

guarded against. It will insure their receiving their ultimate form while those are still connected with the survey by whom they were made, and who are therefore responsible for them. Where the means of reducing work are barely sufficient to give the results immediately called for, there is, of course, a tendency to postpone what is not essential to such results. The means being furnished for finally working up and publishing the observations would secure us against the accumulation of a mass of records which, at the close of the survey, must necessarily be published, and under much less advantageous circumstances than at present. I have thought it my duty to insert an item in the appropriation for the next fiscal year for beginning the publication of observations, intending that this should be done annually or biennially, as might be found most expedient, bringing out by degrees, at the same time, the observations of former years.

The office work of the survey has, by great diligence on the part of the persons employed, and by the excellent administrative arrangements of the assistant in charge, Major I. I. Stevens, kept close to the field work. In no former year have so many preliminary sketches been promptly issued, and so much information of various kinds been published, or furnished to the departments of the government and their officers, or to individuals. Any one who desires results of the Coast Survey, is authorized to receive them on application to the Treasury Department; nor has any such application under this general regulation ever been refused. The actual cost of tracing maps or copying data is the only expense attending the obtaining of them; and the only condition in their use is, that credit for them shall be given to the work from which they have been obtained. A list of the calls thus answered is given in the Appendix No. 7, and serves to show the great field of usefulness which is thus occupied. The published maps of the survey are in like manner furnished at fixed prices marked upon them, to all who may choose to become agents for their sale, and upon precisely the same terms to all—the only stipulation being that they shall be sold at the prices marked upon them. This is in addition to the distribution made by act of Congress to literary and scientific institutions, and to associations connected with commerce and navigation.

Assistance has been rendered to the Engineer department by communicating the surveys of harbors already made, or by directing our work in localities where the survey was in progress, so as to meet the immediate wants of that department.

The examinations for the sites of light-houses and beacons, and for placing buoys, have been made in the cases required by the Light-house Board, and under the acts of Congress of 1851 and 1852, as far as the surveying season has included the localities of which the examination was required. Detailed statements of the progress in execution of this duty will be found in a subsequent part of this report.

During the past year we have lost by death five officers of the survey; and as all were in youth or middle life, the service must be considered as one of more than ordinary exposure. Assistant J. B. Glück, who died in February last, of the consequences of inflammatory rheumatism, was one of the most useful and beloved members of the service, and as a topographer had no superior in the United States. Assistant Woods Baker was one of the victims to the explosion of the boiler of

the steamboat Reindeer, when passing from one station to another. He had a thoroughly scientific mind and training, which rendered him useful from the first period of his joining the survey, and required only experience to place him among the foremost in its ranks. Assistant Joseph Ruth was lost by drowning in Columbia river while engaged in duty there; he entered the survey when quite a youth, and had made himself expert in all its operations, though still quite young at the time of his death. These officers have left little to their families but the inheritance of a good name.

The organization of the Coast Survey under the act of Congress of 1832 has so repeatedly been explained, and its advantages enforced, that it is unnecessary to dwell upon it now, further than to remark that it continues to commend itself by efficiency and economy, and by its peculiar adaptation to the scientific and practical character of the work. The principle that the work is temporary, to be urged onward to completion as fast as means can be obtained, and not the work of a permanent corps, is a cardinal one. The power of the Treasury Department, under the law, to regulate the compensations of the civilians thus temporarily employed, is one great source of the success of the work, giving it vitality by recognising the principle of promotion by merit. The tests which such a work presents by its results make this principle of easy and sure application, the quantity and quality of work under the particular circumstances of each case being determinable with mathematical precision.

The detail of officers of the army for the work which had been interrupted by the Mexican war was resumed in 1850, and it has been my endeavor to obtain the services of as many of those whose studies and disposition lead them to desire to be detailed for the work, as could be spared by the War Department. There are now six officers of the two corps of Engineers on the survey, and eight officers of the line; and as fast as the necessary preparatory training in the practical parts of the work is had, they are placed in positions of responsibility adapted to their particular qualifications. A list of the army officers attached to the work will be found in the Appendix No. 2, *bis*.

The wants of the naval service have rendered it difficult to obtain the number of officers required for hydrographic work of the survey, especially during the past two years; and when officers have been detailed, they have, as a rule, been relieved at such short periods as to prevent them from acquiring the necessary experience to render effective service. The chiefs of parties, only, have been an exception to this rule, and great personal exertions on their part have been necessary to make up for the want of experience in the junior members of their parties. The understanding had by the Secretary of the Treasury with the Secretary of the Navy, that details of the junior officers shall be made for two years' service, of chiefs of parties for three, with renewal for three years at the request of the Treasury Department, and a consideration of special cases of peculiar adaptation to the service, beyond this, will, it is expected, remedy the evil under which this branch of the work has suffered for a few years past from frequent changes. The expense of these changes has also borne heavily upon us for the transportation of officers when first detailed for the work. This,

which was formerly paid by the Navy Department, has been exacted from the Coast Survey appropriation, and when ordered from long distances, and soon detached to give place to others also from a distance, the expense has been a heavy one. There were attached to the Coast Survey on the first of January, twenty lieutenants and twenty-six passed midshipmen, two assistant surgeons, and eleven assistant engineers. A list of their names is given in the Appendix No. 3, *bis*. There are nine hydrographic parties, averaging, when afloat, eight officers, and when engaged in office work about three. The only naval officers who were attached to the Coast Survey Office in Washington for the purpose of revising hydrographic work have recently been detached.

In the Appendix No. 1, a table is given showing the occupation of the field and hydrographic parties during the past year. My own work of this sort is classed with that of the other chiefs of parties, and the visits of inspection are referred to in the notices of the several sections. The office work is stated in detail in the body of my report. The several parties receive detailed instructions from me before taking the field, and make monthly reports of progress, securing by the first a systematic plan of work, in which the different operations are made to harmonize; and by the second, such modifications as changing circumstances require. The facilities for consultation and direction afforded by the telegraph, in most sections, have sensibly increased the directness of superintendence. I have nevertheless redoubled my exertions so to arrange the details of the work that more time might be given me for discussing its results, especially those which combine scientific importance with practical utility.

The general progress of the field and office work during the past year is presented in the following paragraphs, in as condensed a form as the nature of the subject permits; and more detailed information in relation to it will be found in a subsequent part of the report. This statement is followed by a general sketch of the probable progress for the next fiscal year, upon which the estimates are founded.

SECTION I. *Coast of Maine, New Hampshire, Massachusetts, and Rhode Island.*—Seven parties have been employed in this section during the whole or part of the season—five land and two hydrographic parties. One of the topographical parties worked two plane-tables. One of the hydrographic parties had three vessels during part of the season, one of them a steam-vessel, and both had two vessels throughout the working season. Cape Small Point, at the mouth of the Kennebeck, was occupied in connexion with the primary triangulation, the reconnaissance for which was extended so as to prepare for the work of the next season. The secondary triangulation of Portland harbor was made, and that of Casco bay commenced. The heights of important points between Portsmouth, New Hampshire, and Saco, Maine, were determined in connexion with the secondary triangulation. The topography of Cape Ann was nearly completed, and extended to Essex, Massachusetts. The topography north of Saco, Maine, was extended to include Cape Elizabeth. The hydrography of the vicinity of Gay Head, and of Nantucket shoals, was extended beyond Fishing Rip, the

determination of which was an important result of the season's work. Examinations were made for light-houses, &c., on the coast of Maine and southern coast of Massachusetts. The hydrography of Muskeget channel was completed. A newly discovered rock in Buzzard's bay, near the entrance to New Bedford harbor, was determined. The tidal observations of the passages between Martha's Vineyard sound and Buzzard's bay were completed, and tides and currents observed at stations in the Vineyard and Nantucket sounds. In part of these observations self-registering tide gauges were used. Current observations were made in Portsmouth, Newburyport, and Salem harbors. The hydrography of Annisquam and Ipswich harbors was executed, and that of Portland harbor was begun. The regular tidal stations in the section were kept up. Views for the charts were taken, at the entrance to Buzzard's bay, of Martha's Vineyard and Muskeget channel, of Billingsgate light, including Wellfleet, and Boston harbor.

The results of the chronometer expedition between Cambridge and Liverpool have been under computation, as those of the telegraphic connexion of Cambridge, Bangor, and Halifax, for difference of longitude. The computations of the season's work have been kept up. The following maps and charts have been in progress, or published during the year: Davis' South Shoal; Salem harbor; Boston harbor; Wellfleet harbor; Muskeget channel, Eastern series Nos. 1, 2, and 3; Portsmouth harbor; and Newburyport harbor.

SECTION II. *Coast of Connecticut, New York, New Jersey, Pennsylvania, and Delaware.*—This section has required but little additional work during the season. Astronomical and magnetic observations were made at one of the primary stations. The triangulation of the Hudson has been continued. Surveys from time to time have been made of the rocks removing from Hell Gate by blasting. Examinations have been made in relation to buoys and beacons. The regular tidal observations have been continued.

The charts published and in progress during the year in this section are: Off-shore chart from Gay Head to Cape Henlopen; Hell Gate; changes at Sandy Hook; light-house sketch of New York harbor; Long Island sound, No. 1; mouth of Connecticut river; south side Long Island, Nos. 2 and 3.

SECTION III. *Coast of Delaware, Maryland, and Virginia.*—Eleven parties have been at work in this section—nine on the land work, and two in the hydrography, besides the occasional examinations made in regard to buoys and light-houses. One of the hydrographic parties had a steam-vessel, in addition to a sailing-vessel. The longitude of Petersburg from Washington has been determined by telegraph, the latitude obtained, and an azimuth given for the work on the James and Appomattox rivers. The primary triangulation of the Chesapeake has been completed within part of a season's work. The secondary triangulation of the Chesapeake has been continued; that of the outer coast has been extended to connect at the Capes with the main work. The triangulation of the Appomattox river has been made, and that of James river has been commenced. The topography of the shores of the Chesapeake has been extended south from the previous season's limit; that of the outer coast to the limits of the shore-line required by the hydrographic party; that of the Appomattox river has been nearly completed, and the

verification of that of the Patapsco and its vicinity has been continued. The hydrography of the ocean coast has made excellent progress, extending now to Matchipungo inlet, within seventeen miles of Cape Henry; that of the Chesapeake near the Capes has been continued, connecting with the work of last year on the "Middle Ground," and extending north from Cape Charles along the eastern shore. An examination, near the Capes, of Fisherman's bay and its approaches, has been made. The hydrography of the Appomattox river has been completed. A hydrographic reconnaissance of Harrison's bar, in James river, has been made. The Belvidere shoal, at the entrance to the Patapsco, and the place of a wreck in Hooper's straits, have been determined and marked. The site of the light-house on Seven-foot Knoll, Patapsco entrance, has been designated. An examination for a light-house at Pongoteague creek, near Pocomoke sound, has been made. Tidal observations at Old Point Comfort have been continued, and a self-registering gauge has been placed there.

The following maps and charts have been published, or are in progress: Chincoteague shoal; Fishing or Donoho's Battery; entrance Chesapeake bay; Chesapeake bay, sheets Nos. 1,2, and 3, scale $\frac{1}{80,000}$ and scale $\frac{1}{400,000}$; Patapsco river; Appomattox river; and seacoast of Delaware and Maryland.

SECTION IV. *Coast of Virginia and North Carolina.*—Eight parties have been employed in this section during part of the season—one in reconnaissance, one in triangulation, two in triangulation and plane-table work, one in plane-table work, and three in hydrography. A reconnaissance from Cape Fear north to New river, and southward, is in progress. The secondary triangulation has been extended north over Currituck sound, nearly to the Virginia line, south from Ocracoke and north from Beaufort, and over Core sound nearly to a junction with the former, over Cape Fear entrance and part of the river; the topography has been extended from Hatteras inlet, with a short interval, north to the limits of the triangulation, and that of Ocracoke inlet and Cape Fear entrance has been executed. The hydrography of Cape Fear entrance has been completed. Off-shore work has been executed in the section generally from the Capes of Virginia to Cape Roman. The hydrography of Currituck sound has been continued; that of Ocracoke inlet completed.

The following maps and charts have been in progress, or have been published: Beaufort harbor; Frying-pan shoals; Cape Fear river; New inlet; Hatteras shoals; Albemarle sound, $\frac{1}{80,000}$ in two sheets, and the same on a scale of $\frac{1}{200,000}$; and New river and bar—also Ocracoke inlet.

SECTION V. *Coast of South Carolina and Georgia.*—The primary triangulation from the Edisto base to Charleston has been continued, three stations having been occupied in part. The astronomical observations at the Charleston observatory have been continued. The secondary triangulation of the Edisto, Dawho, Wadmelaw, and Kiawah rivers, and the triangulation of the Savannah river from Fort Pulaski to the head of Argyle island, above the city of Savannah, have been completed. The topography of the shores of Savannah river has kept up with the triangulation, and the hydrography of the river within the same limits has been completed. The hydrographic examinations required on Charleston bar have been

made. Cape Roman shoals have been examined. Tidal observations have been kept up at Charleston and in Savannah river. Examinations for light-houses have been made in this section.

A manuscript map of Charleston harbor, on a large scale, has been prepared for the Charleston Chamber of Commerce. The engraved map of the harbor has made considerable progress, and sketches of North Edisto river, Bull's bay, the chart of North Edisto river, reconnaissance of Savannah river, and entrance to Savannah river, are in progress, or have been published.

SECTION VI. *Coast of Florida, keys and reefs.*—Five parties have been engaged on this coast during part of the season. The reconnaissance of St. Mark's harbor has been made. Observations for latitude, azimuth, and longitude, and for magnetic variation, &c., were made at Cedar Keys, and at St. Mark's. The triangulation of the reef and keys employed two parties during the whole season, who have extended it outside from Cape Florida to Point Elizabeth, and inside, to include the Walker keys, to Barnes's sound. The screw-pile signals, which make a heavy draught upon our limited means, are necessary for navigation, and should be furnished independently of our resources. The triangulation of Cedar Keys has been extended, and the topography in connexion with it executed. The hydrography of Key West harbor has been completed; that of the reef has been carried from Narrow Cut, near Cape Florida, to Triumph reef; that of Legaré harbor of refuge, near Triumph reef, has been completed; that of Rebecca shoals and the vicinity of Key Biscayne has been commenced. The hourly tidal observations at Key West were continued to complete the year, and others made at Cedar Keys and Cape St. George. A general reconnaissance has been carried west of St. Mark's, into the next section. Sketches of Key West, Channel No. 4, Cedar Keys, and Rebecca shoals, have been published.

SECTION VIII. *Coast of Alabama, Mississippi, and Louisiana.*—The reconnaissance for primary triangulation has been extended. The secondary triangulation has covered Lake Borgne, and the signals have been placed in part of Lake Pontchartrain. The topography has been carried from Montgomery station to Malheureux Point, on Lake Borgne. The north end of Chandeleur island has been surveyed. The hydrography has included Horn Island pass; Naso roads, off the Chandeleur islands; part of Mississippi sound, outside work off Dauphine island, west of Mobile entrance; and the reconnaissance of the South and Southwest Passes of the Mississippi.

The following charts and sketches have been published, or are in progress: Mobile bay, $\frac{1}{200,000}$; Pass Christian; Cat island, tidal diagrams; entrance to Mobile bay; and Mobile bay, sheets Nos. 1 and 2, scale $\frac{1}{80,000}$.

SECTION IX. *Coast of Louisiana and Texas.*—The primary triangulation, and secondary connected with it, has been extended westward to the mouth of the Rio Brazos, the reconnaissance being carried to the head of Matagorda bay. The topography has reached nearly the limits of the triangulation, having embraced West bay and Galveston island, and extended as far as Jupiter station across the Brazos river. The hydrography of Galveston lower bay has been nearly completed, and that of the upper bay commenced. The hydrography of the

approaches to Galveston bay has been completed. Hourly tidal observations have been made at Galveston. The charts of Galveston entrance, and a new edition of Galveston bay, are in progress.

SECTIONS X AND XI. *Coast of California and Oregon.*—The geographical positions of Ewing harbor, Presidio, (San Francisco bay,) and Scarboro' harbor, have been determined, and preliminary determinations of those of Santa Cruz, San Simeon, San Luis Obispo, Santa Barbara, Prisoners' harbor, San Pedro, Santa Catalina, San Clemente, San Nicolas, Cuyler's harbor, False Dungeness bay, and Point Hudson, made, in connexion with the hydrographic reconnaissance of the coast and islands. Magnetic observations have been made at the first-named geographical points. The triangulation of San Francisco bay and its approaches has been completed, and that of San Pablo bay has been nearly completed. The harbors of Monterey and San Diego, and the Columbia river from its entrance to Birnie's, a point thirty-five miles above, have been triangulated. The topography of the Bay of San Diego, commenced last year, has been completed, and that of the Bay of Monterey continued. Topographical surveys of Cape Adams, of Santa Barbara, and of Cape Flattery, have been executed. The topography of San Francisco has been completed, and that of the bay has made considerable progress. A hydrographic reconnaissance of the coast south from Monterey to San Diego, of the harbors and roads of the Santa Barbara islands, and of the coast of Oregon north from the Columbia river, has been made, and the former preliminary reconnaissance from San Francisco to Columbia river is under revision. The hydrography of Monterey, San Diego, and Humboldt harbors, and of Columbia river entrance, has been executed. The hydrography of San Francisco entrance is in progress.

A steam-vessel was purchased during the year in San Francisco, to replace the Jefferson, lost on the coast of Patagonia. This vessel will require new boilers and other repairs during the coming year.

The following maps and charts have been published, or are in progress: Catalina harbor; Monterey harbor; San Francisco city; Prisoners' and Cuyler's harbors, and northwest anchorage of San Clemente; San Pedro; Santa Cruz; San Simeon; San Luis Obispo; Point Conception, and Coxo; Alden's reconnaissance from San Diego to Sir Francis Drake's bay; Mare Island straits; entrance to San Diego; Humboldt bay; McArthur's reconnaissance, third edition; San Francisco bay, and Santa Barbara; mouth of Columbia river, and Cape Hancock.

The usual office work belonging to the survey generally, consisting of computations, work of assemblage and registry, reductions of maps and charts, engraving of sketches, and the like, has advanced steadily.

The estimates herewith submitted suppose the same aid which has been furnished during the past year by the Navy and War Departments, by the detail of officers. There are now attached to the survey fourteen officers of the army and fifty-nine of the navy.

ESTIMATE FOR THE FISCAL YEAR 1853–'54.

General expenses for all the sections, namely: rent, fuel, postage; materials for drawing, engraving and printing; carpenter's work and materials; instrument maker's work and materials; blank-books, stationery, printing and ruling forms; binding; transportation of instruments; maps and charts, and miscellaneous office expenses; purchase of new instruments, books, maps, and charts $16,000

SECTION I. *Coast of Maine, New Hampshire, Massachusetts, and Rhode Island.* FIELD-WORK.—To extend the primary triangulation in Maine eastward, and to make the reconnaissance, and the astronomical and magnetic observations connected with it, to the Penobscot, nearly; to continue the secondary triangulation of *Casco bay*, and determine the heights of stations; to continue the topography of the coast between *Portsmouth* and *Portland*, and that of *Portland* harbor; to continue the topography of the coast of *Massachusetts* from *Ipswich* northward; to complete the hydrography of *Nantucket shoals;* to execute that of *Nantucket sound* and *entrance* to *Martha's Vineyard;* to complete that of the coast of *Massachusetts* between *Boston* and *Cape Ann;* to complete that of *Chatham*, *Massachusetts*, and *York*, *Saco*, and *Kennebunk*, *Maine*, harbors; to continue that of *Portland* harbor; to continue observations of tides and currents at stations on the coast; and to take the views required for the coast chart, Eastern series No. 3, and for harbor charts. OFFICE-WORK.—To make the reductions and computations for the section; to make the drawing of preliminary hydrographic sketches from the season's work on the coast of *Massachusetts;* to make that of *Gloucester*, *Annisquam*, and *Ipswich* harbors, *Massachusetts;* to commence that of *Portland* harbor, and those of *York*, *Saco*, and *Kennebunk*, *Maine;* to complete the engraving of *Boston* harbor, *Newburyport* harbor, *Portsmouth* harbor, and *Muskeget* channel; to continue that of coast chart, Eastern series Nos. 1 and 2; to commence that of No. 3, and to commence that of *Gloucester*, *Annisquam*, and *Ipswich*, *Massachusetts*—will require 37,000

SECTION II. *Coast of Connecticut, New York, New Jersey, Pennsylvania, and Delaware.*—To continue the triangulation and hydrography of the *Hudson*, and to execute verification work in the section; to continue observations of the tides and currents; to complete the engraving of the middle sheet of the south side of *Long Island* and of preliminary sketches in the section, and to commence that of the next sheet—will require 7,000

SECTION III. *Coast of Delaware, Maryland, and Virginia.*—To complete the triangulation of the *Chesapeake* and adjacent bays near the Capes of *Virginia;* to make the astronomical and magnetic observations required; to continue the triangulation of the *James river*, and to commence that of the *Potomac* or of *York river;* to continue the topo-

graphy of the western and eastern shores of the *Chesapeake* towards the Capes, and probably to commence that of *James river;* to complete the topography of the outer coast to the Capes, nearly; to continue the hydrography of the outer coast, to include the Capes and entrance of the *Chesapeake* and that of the bay to the entrance, nearly; to commence that of the *James river;* and to continue the tidal observations in this section. OFFICE-WORK.—To make the computations and reductions required by the work of the section; to make the drawing of preliminary sketches of the season's work; to make the drawing of the preliminary sheet of the outer coast of *Maryland* and *Virginia* to *Matchipungo inlet;* to complete that of sheet No. 3 of the *Chesapeake*, and to continue that of the second series, south of the *Potomac*, and to commence that of *James river;* to continue the engraving of the upper series of *Chesapeake bay* and of the general chart; to keep that of the outer coast up to the season's work, and to continue that of the *Appomattox* and *James rivers*—will require $33, 000

SECTION IV. *Coast of Virginia and North Carolina.* FIELD-WORK.—To make the reconnaissance required in this section from the *Cape Fear* south, and north from *New river;* to continue the primary triangulation of *Pamplico sound;* to continue the secondary triangulation to its connexion with the *Chesapeake* northward; to complete that over *Core sound*, and to continue that of the *Cape Fear;* to continue the topography of the ocean and sound shores from *Hatteras inlet* to *Core sound*, and that of *Core sound* to *Beaufort*, and to continue that of the ocean shore towards the capes of *Virginia;* to complete the hydrography of *Currituck* and *Core sounds*, of *Ocracoke inlet*, of *Cape Fear* entrance; to continue that of *Pamplico sound*, of the seacoast between *Bodie's island* and *Hatteras*, and of the *Cape Fear*, and to continue the tracing of the Gulf-stream in this section. OFFICE-WORK.—To make the computations and reductions required by the work of the section; to draw the preliminary sketches of *Core sound*, *Cape Fear* entrance, and others required by the season's work; to complete the drawing of *Albemarle*, *Roanoke*, and part of *Currituck sounds;* to continue that of *Cape Fear* entrance and river; to continue the engraving of these charts, and complete that of the preliminary sketches—will require 25, 000

SECTION V. *Coast of South Carolina and Georgia.* FIELD-WORK.—To continue the primary triangulation, and the secondary triangulation connected with it, eastward beyond *Charleston;* to complete the secondary triangulation of *Savannah river* and *Calibogue sound;* to continue that from *St. Helena sound* to *Beaufort;* to complete the topography of the shores of the *Savannah river* and entrance; of *Kiawah*, *Wadmelaw*, and *John's* islands, and of the shores of *Stono* and *Ashley* rivers; to continue the hydrography of the ocean coast between *Charleston* and *Savannah* entrances, and to complete that of the *Savannah river* from the entrance to the north end of *Argyle*

island, and of *Cape Roman shoals;* to continue the exploration of the Gulf-stream in this section, and to continue the tidal observations at *Charleston* and *Savannah* entrances. OFFICE-WORK.—To make the computations and reductions required by the work of the section; to complete the drawing of *Savannah river*, including the work to the head of *Argyle island*, of the sketch of *Cape Roman shoals*, and of the sketches required by the season's work; to complete the engraving of *Charleston harbor* chart, and of *North Edisto harbor of refuge*, and to continue that of *Savannah river* chart—will require $23, 000

SECTION VI. *Reefs, keys, and coast of Florida.*—(See estimate for usual appropriation for that special object.)

SECTIONS VII AND VIII. *Coast of Florida, Alabama, Mississippi, and Louisiana.* FIELD-WORK.—To continue the general and particular reconnaissance of this coast; to continue the primary triangulation towards the Delta of the Mississippi, the secondary triangulation to *New Orleans*, and from the *Chandeleur islands* south; to complete the telegraph connexion of *Washington*, *Mobile*, and *New Orleans*, for difference of longitude; to make the astronomical and magnetic observations required in connexion with the triangulations; to continue the topography of the coast and shores of *Lake Pontchartrain* and of the *Chandeleur islands;* to continue the hydrography of *Louisiana bay*, and of the passes of the *Mississippi* and their approaches; and to make the necessary tidal observations on the coast of *Louisiana.* OFFICE-WORK.—To make the computations and reductions required by the work of the section; to draw and engrave the work of *Ship shoal*, *Louisiana*, and the sketches required by the season's work; to continue the drawing of the general coast chart from *Mobile bay* westward, and its engraving; to continue the engraving of the chart of *Mobile bay;* to complete the engravings of *Ship island* changes and of *Naso roads*, *Chandeleur islands*—will require 24, 000

SECTION IX. *Coast of Louisiana and Texas.* FIELD-WORK.—To make particular reconnaissances for the main triangulation; to extend the main and secondary triangulation westward and southward, from *Matagorda bay*, and to make the astronomical and magnetic observations connected with them; to continue the hydrography southward and westward; to complete that of *Matagorda bay;* to make a hydrographic reconnaissance of the mouth of the *Rio Grande*, and to continue the tidal observations. OFFICE-WORK.—To make the computations and reductions required for the section; to continue the drawing of the chart of *Matagorda bay*, and to complete that of *Galveston bay;* to make the engraving of preliminary sketches required, and to continue that of the chart of *Galveston bay*—will require 21, 000

SECTIONS X AND XI. *Western coast, California and Oregon.* (See estimate provided for, as last year, by special appropriation.)

Total, exclusive of *Florida reefs and keys*, and of *western coast* . . 186, 000

I would further recommend, in accordance with the remarks of this and former reports, that an appropriation be asked for publishing the observations made in the progress of the survey of the coast of the United States, of $20, 000

SECTION VI. *Reefs, keys, and coast of Florida.* FIELD-WORK.—To continue the general reconnaissance of the coast; to continue the triangulation of the *Florida* reefs and keys from *Lower Matacumbe* westward; to complete that of *Walker's keys* and *Barnes's keys;* to continue that of *Cedar keys*, of *St. Andrew's bay*, and near *St. Mark's;* to continue the topography of the keys; to continue the hydrography of the reef southward and westward, and to make the examinations of harbors of refuge of *Rebecca shoal*, and others, in the vicinity of the *Tortugas.* OFFICE-WORK.—To make the computations and reductions required by the work of the section; to continue the drawing of the first sheet of the reef from *Cape Florida;* to make the drawings and sketches of harbors and shoals from the previous season's work, including the *Rebecca shoals, &c., Cedar keys*, and *St. Mark's;* to engrave the sketches and preliminary charts, and to commence the general sheet of the reef—will require 30, 000

SECTIONS X AND XI. *Coast of California and Oregon.* FIELD-WORK.—To continue the determinations of geographical positions, absolute and relative, of capes, headlands, &c.; to complete the triangulation of *San Pablo bay*, and to continue that of the *Straits of Karquines, Suisun bay*, &c., and of the several harbors on the coast; to continue that of the *Columbia* and *Willamette rivers*, and of *Puget's sound;* to continue the topography in connexion with these several triangulations, and with the hydrography; to complete the revision of the hydrographic reconnaissance of the coast, that of *San Francisco* entrance and bay, and to continue that of *San Pablo bay* and *Santa Barbara* channel, of *Columbia river*, of *Puget's sound*, and of the harbor of the coast, including current repairs to the steam-vessel used by the hydrographic party. OFFICE-WORK.—To make the computations of geographical positions and others required for the work; to complete the drawing and engraving of revised reconnaissance and harbor charts; to continue that of *San Francisco* entrance and bay, and of *Columbia river* entrance; to reduce and engrave the sketches resulting from the previous season's work, and received from current work—will require 150, 000

The appropriations for the fiscal year 1852–'53 were—

1. For the coast of Atlantic and Gulf of Mexico, generally 186, 000
2. For the Florida reefs, keys, and coast 30, 000
3. For the Pacific coast 150, 000

Being the same sums now required for these objects.

The next division of my report contains a more special notice of the several operations of the parties under charge of the assistants and others, divided accord-

ing to the sections of the coast, and carried, as usual, to the first of November, from the reports of the officers. This is followed by an account of the office work, and by an appendix containing special reports on matters referred to in the body of the report, statistics, and the like. The usual table of the occupations of parties is in the Appendix No. 1, and the statistics of progress are in No. 4.

The directions of the Treasury Department in regard to the execution of the provision of law requiring examinations of sites for light-houses, &c., with a table showing the progress in the work, are given in the Appendix, Nos. 33 and 34, and the special reports on the subject will be found in the Appendix, with references under the head of the sections where the work has been executed.

SECTION I.—FROM PASSAMAQUODDY BAY TO POINT JUDITH, INCLUDING THE COAST OF MAINE, NEW HAMPSHIRE, MASSACHUSETTS, AND RHODE ISLAND. (SKETCH A.)

In this section there have been engaged during the season five land parties and two hydrographic parties; one of the land parties engaged in primary triangulation, one in secondary, one in secondary triangulation and reconnaissance, and two in topography, one of which latter was a double party. Both of the hydrographic parties were double, one employing a steamer and sailing-vessel, and the other two, sailing-vessels. One primary triangulation station has been occupied in extending this part of the work to the eastward, and the reconnaissance for its further continuation made as far as Mount Desert, Maine. The observations for the telegraphic difference of longitude between Cambridge, Massachusetts, and Bangor, Maine, were completed. The secondary triangulation of the coast of New Hampshire and Maine has been continued northward as far as Saco river, Maine; and that of Casco bay, Maine, has been commenced. The elevations of most of the triangulation points from Portsmouth, New Hampshire, to Saco, Maine, have been determined by the theodolite, and the larger elevations by the theodolite, barometer, and levelling, for the purpose of comparing the value of the different methods.

The topography of the harbor of Annisquam, Massachusetts, and its vicinity, has been entirely executed, and that of the harbor of Essex and its vicinity nearly completed. That of Cape Elizabeth, Maine, has advanced from the vicinity of Richmond's island to near Portland.

The hydrography of Nantucket South Shoals to its farthest limit southward and eastward (including Fishing Rip,) of the vicinity of Gay Head, and of the channel between Gay Head and No-Man's Land, has been executed; that of Ipswich and Annisquam harbors, Massachusetts, and of the Isle of Shoals, has been completed, and that of Portland harbor, Maine, has been commenced. A series of tidal and current observations has been made at several stations in Martha's Vineyard sound, Ipswich, Annisquam, Portsmouth, and Portland harbors. An officer has been engaged during part of the season in taking views on the coast of Massachusetts for the sheets of Eastern series, and of Boston harbor. During a part of the season both of the hydrographic parties have made examinations into the necessities for lights, beacons, buoys, &c., provided, by the recent act of Congress, for several localities on this section of the coast.

The computations and reductions of the work of the section have been advancing so as to keep up with the field work. The following charts and sketches are now in progress of drawing and engraving: Salem harbor, Boston harbor, Wellfleet harbor, Muskeget channel, (Nos. 1, 2, and 3, of Eastern series,) Portsmouth harbor, and Newburyport harbor. A new edition of the sketch of the Nantucket shoals has been published during the year.

Reconnaissance.—The reconnaissance for the extension of the primary triangulation northward and eastward in this section has been prosecuted by Assistant C. O. Boutelle and Brevet Major Henry Prince, U. S. Army, assistant in the Coast Survey. This has now advanced as far as the line Mount Desert and Ebeeme Mountains. (See Sketch A.)

Primary triangulation.—At the close of the operations in Section III, in August, my party was transferred to Cape Small Point, Maine, to complete the observations commenced there last year, in connexion with the primary triangulation of the coast eastward. (See Sketch A.) 490 observations, upon six primary and four secondary stations, were made, and one azimuth mark observed upon. The area covered by the work is 1,275 square miles. The instrument used was the thirty-inch theodolite, (Troughton and Simms, C. S. No. 1;) 363 observations for vertical angles upon twelve points were made with the micrometer of this instrument, and twelve observations on two points for double zenith distances, with a six-inch Brunner theodolite, (C. S. No. 51.)

The astronomical observations requisite for the occupation of this station were made last year.

I was assisted in the greater part of these observations by Lieut. W. P. Trowbridge, U. S. Corps of Engineers, assistant in the Coast Survey, in whose charge the party was left from the 1st of October to the 10th of November, (my presence being required in Washington at the meeting of the Light-house Board, of which I was appointed a member,) when, from the advance of the season, operations were closed, and Lieut. Trowbridge proceeded to Section III, to make the triangulation of the James river, below and near Richmond, Virginia.

Some of the most remarkable instances of lateral refraction which I have had occasion to notice occurred at this station, affecting especially the secondary stations in Casco bay, and Ossipee and Mount Independence, to the south of Cape Small, and Monhegan to the east. In the directions of Mount Blue and Ragged mountain, on the contrary, there was remarkable uniformity of position.

Telegraphic difference of longitude.—These operations for the difference of longitude between Cambridge, Massachusetts, and Bangor, Maine, and between Bangor and Halifax, Nova Scotia, under the general direction of Professor S. C. Walker, were brought to a close on the 23d of December, 1851. Professor Bond, of Cambridge, and Captain Shortland, R. N., of the British Admiralty survey of Nova Scotia, had concerted the connexion of these two places by the telegraph, and it was considered important to furnish an intermediate station in Maine, and to connect our work with the British survey. The operations were entirely successful, as far as Cambridge and Bangor were concerned, but the number of

signals exchanged between Bangor and Halifax was few. Check computations are required before stating the results of this work.

Secondary triangulation.—Assistant C. O. Boutelle commenced the triangulation of the harbor of Portland, Maine, and of Casco bay, (see Sketch A, No. 1,) on the 21st of July, and continued it, with little interruption, until the 5th October. Mr. Boutelle was assisted during the latter part of the season by Lieut. W. R. Palmer, Topographical Engineers, assistant in the Coast Survey, and during the whole season by Sub-Assistant George A. Fairfield and Mr. B. Huger. This work extended over that part of Casco bay lying west of a line drawn from Mount Independence to Halfway Rock, and embracing Portland harbor, and in its execution two stations of the first order, and nine of the second, were occupied; 255 angles upon 211 objects were measured at six of the stations; 48 zenith distances being measured by 452 observations.

The instruments used in the above operations were Gambey theodolites, ten-inch, C. S. No. 43, and eight-inch, C. S. No. 24.

Captain T. J. Cram, U. S. Topographical Engineers, assistant in the Coast Survey, completed his work of secondary triangulation from the boundary of New Hampshire to Saco, Maine, (see Sketch A, No. 1,) after the date of my report of last year, occupying eight stations, in addition to the work of that season, namely: three primary, (for verification of the secondary work,) three secondary, and two tertiary stations. One hundred and ninety-eight angles were measured by 2,400 observations, made on 59 objects with a twelve-inch theodolite, (C. S. No. 18.)

The instructions of Captain Cram for this year were directed towards obtaining the differences of heights of the stations in his previous triangulation, and incidentally towards testing the relative value of the different modes of determining heights by the measurement of reciprocal vertical angles, by the barometer and by levelling. The simultaneous observations by vertical angles, and of the barometer at two connected stations, formed part of this plan, and the selection of stations so as to obtain lines along which the physical circumstances that may be supposed to influence terrestrial refraction would be different. These observations were made at eleven stations, and upon forty-one stations.

In his report Captain Cram remarks: "At the different stations occupied, a sufficient number of observations have been taken in the vertical planes to form a completely connected chain of vertical triangulation throughout the whole scheme, and to connect it with the primary; and great pains taken to select such stations for simultaneous observations as would give *all the requisite conditions*, as regards variety of distances, variety of elevations, variety of ground and water, variety of vegetation, and variety of all other circumstances of a physical nature which may be supposed to affect refraction of light, in order to determine the coefficient of refraction in different hours of the day, between sunrise and sunset, in clear weather, in cloudy weather, and even in slightly rainy weather—indeed, for all times in the day when a signal can be observed upon.

"The elevations of all the stations in the vicinity of the sea, both primary and secondary, above tide-water, have been determined by direct levelling with the levelling instrument, in a manner to free the results from the effects of terrestrial

refraction. The heights of thirty-three stations above tide have thus been determined, and among these are those whose elevations will likewise result from measurement by theodolite and barometer.

"The barometric observations with the two portable or mountain barometers (and with an aneroid) have been very particularly attended to, and much multiplied at many of the stations, simultaneously with the observations by the theodolites, with a view of comparing the methods of determining the elevations of the stations by the barometer, by the theodolite, and by the levelling instrument."

Tidal observations were made in connexion with the levellings of the points near the ocean, and with the permanent tide-gauge in Portsmouth harbor.

Topography.—There have been employed in this section during the season two parties engaged in this branch of the work—one under the immediate charge of Assistant H. L. Whiting, and the other under that of Assistant A. W. Longfellow.

Assistant Whiting's work embraced two sheets, one of which was completed and the other nearly so: the former contains the harbor of Annisquam and its vicinity, (see Sketch A, No. 1,) extending east to the limit of last year's work; the latter embraces the harbor of Essex and its vicinity, extending from three to three and a half miles back from the shore, and along Essex river.

The work of the party is thus stated:

	Sheet completed.	Sheet not completed.	Total.
Miles of shore-line	26	24½	60½
Miles of road	21	5½	26½
Square miles of area	12	5	17

The operations of the party commenced about the middle of August, and were closed on the last of October; they were under the general direction of Assistant H. L. Whiting, who was also occupied in putting in ink the drawing of his past season's work in Sections III and V. One of the sheets was executed by Sub-Assistant R. M. Bache, and the other by Sub-Assistant W. S. Walker, until his health became so bad as to oblige him to leave the field, when Sub-Assistant A. S. Wadsworth took charge of it and continued it.

The sheet on which Assistant A. W. Longfellow has been working, embraces the vicinity of Cape Elizabeth, Maine, extending northward towards Portland harbor. (See Sketch A, No. 1.)

The statistics of the work above are thus given:

Number of miles of shore line surveyed - - - - -	46
Number of miles of road surveyed - - - - - -	33.6
Area in square miles surveyed - - - - - -	10.6

Hydrography.—The hydrographic operations in this section have been executed by two parties—one under the charge of Lieut. Com. Charles H. McBlair, U. S. Navy, assistant in the Coast Survey; and the other under the charge of Lieut. Com. Maxwell Woodhull, U. S. Navy, assistant in the Coast Survey.

The following extracts from the report of Lieut. Com. McBlair, give a full view of the scope and character of the work of his party:

"The vessels employed consisted of the steamer Corwin, relieved in the early part of the season by the Walker, the schooner Nautilus, in charge of Lieut. George W. Doty, and two hired tenders."

"The fields occupied in succession were the Nantucket shoals and the waters in the neighborhood of Gay Head. (See Sketch A, No. 2.)

"The work on the shoals was commenced on the 5th of July, and closed on the 26th of August; that near Gay Head was executed between the 1st and 30th of September."

"The subjoined table exhibits the results that have been obtained:

	Nantucket shoals.	Off Gay Head.
Area completed in square miles	195	71
Lines of soundings—extent in miles	467	142
Number of soundings	4,030	3,010

"The hydrography of the shoals has been extended to its farthest limits in a southwardly and southeastwardly direction. Our season's work embraces a minute examination of 'Fishing Rip,' the northern point of Davis's Bank, and the channel lying between those shoals."

"The survey has been attended with greatly increased difficulties, arising from the remoteness of the field explored from the port of refuge. We have succeeded, however, in placing upon the chart the most eastward and least accessible of the shoals, and such progress has been made in the general hydrography as to warrant the expectation that it may be completed in one more season."

"While prosecuting the soundings the velocity and direction of the currents have been carefully ascertained at the various positions occupied by the station vessels."

"The channel between Gay Head and No-Man's Land, including the determination of 'Old Man's Ledge' and 'Lone Rock,' has been sounded out, and the survey of 'Cox's Ledge,' the 'Southwest Ledge,' and 'Brown's Ledge,' has also been completed by Lieut. Doty, in the Nautilus."

"We have found and determined the position of a rock lying near the eastern channel leading into the harbor of New Bedford, only known to exist within the last two years."

The work has been so far advanced during the last season, although very unfavorable to its progress, as to place it probably within one season's work of completion.

Light-house examinations required by law and the Light-house Board have also been made by this party.

Lieut. Com. McBlair recommends the placing of two buoys in the channel between Gay Head and No-Man's Land—one on Lone Rock, and the other on Old Man's Ledge. He remarks that "this channel is a good deal used, and the guides suggested are indispensable to the safety of passing vessels."

He also recommends, "as extremely useful to vessels approaching the harbor of New Bedford, that two buoy-boats, provided with fog-bells, should be placed near the ship channels—one on 'Middle Ledge,' now marked by a spar-buoy, and the other on the 'Hursel Rock,' recently determined."

Lieut. Com. McBlair was instructed to make preliminary surveys and reports upon the necessity or expediency of placing a light-boat near Succonesset shoal, north channel, Vineyard sound, and of placing a light-boat near Killpond bar, or a light-house in the vicinity of it, at Hyannis. These examinations were called for by the Light-house Board, under the act of Congress approved August 31, 1852. These two localities falling within the limits of Lieut. Com. McBlair's working ground, the examinations were referred to him, and his report upon them, transmitted with my own to the department, may be found in Appendix No. 36.

The party under the command of Lieut. Com. Maxwell Woodhull, U. S. Navy, assistant in the Coast Survey, was charged, during the early part of the season, with the observations of tides and currents in Buzzard's bay and Martha's Vineyard sound. Gauges were put up and hourly observations made at Wood's and Quicks' Holes, and Kettle and Tarpaulin coves, to verify the results obtained there during the previous season. A series of observations on the north and south sides of the Vineyard sound was commenced about the middle of July and completed at the end of August, to ascertain the movement of the tide wave through the Vineyard sound. The stations occupied were Cuttyhunk, Nobsque, Hyannis, Monomoy, Menamsha Bight, Holmes' Hole, Edgartown, Nantucket, and Great Point—nine in all. At two of the stations—Hyannis and Nantucket—self-registering gauges were used. A part of these observations will require repetition.

Twenty stations were occupied for current observations during the season.

On the completion of these observations Lieut. Com. Woodhull proceeded to Annisquam, arriving there about the 10th September, and completed the hydrography of that harbor. The area sounded at this place was about three square miles; thirty miles of soundings were run, three thousand casts of the lead made, and one hundred and twenty-five double angles observed.

The hydrography of Ipswich harbor and Plumb Island sound, from the entrance to two miles above the mouth of the river, was next executed. (See Sketch A, No. 1.) This work covered an area of about twelve square miles. Eight thousand three hundred soundings were made, three hundred double angles measured, and one hundred and fifty miles of soundings were run.

In regard to Ipswich harbor and approaches, Lieut. Com. Woodhull says:

"The river is scarcely so but in name, the channel not being wider at low water than about twenty-five feet, full of impediments, and extremely winding. It is about two miles in extent, at the head of which stands the town of Ipswich. The harbor is but little used save by a small class of coasters, and a number of small craft which are principally employed in the sand-dragging business. The bar is a loose, shifting sand, and has changed greatly since the two light-houses were erected. They were intended at the time they were built as a range-guide over the bar: now, in order to use them in crossing the bar, it becomes a matter of judgment as to the distance they are to be opened from each other; conse-

quently, the safety oftentimes of the vessel and crew mainly depends upon the accuracy of this judgment."

Lieut. Com. Woodhull recommends "that one of these lights be extinguished, and bearings be given to steer by, from time to time, as the bar changes." Seven feet at low water was found to exist on this bar.

Being unable, on account of the prevalence of northeast winds, to make current observations either at Ipswich or Newburyport, (which entered into his instructions,) Lieut. Com. Woodhull sailed for Portland harbor, Maine, arriving there on the 4th of October, and commencing the hydrography of that harbor. The work of this party closed on the 3d of November.

Besides the schooner "Madison," under the command of Lieut. Com. Woodhull, the schooner "Gallatin," under command of Lieut. George H. Preble, U. S. Navy, was attached to this party. Lieut. Preble assisted in the tidal observations in Buzzard's bay and Martha's Vineyard sound; gave transportation and assistance to Lieut. A. A. Gibson, U. S. Army, assistant in Coast Survey, in making the views in this section noticed in a subsequent paragraph, and took the currents of Portsmouth harbor, New Hampshire.

In the early part of the season Sub-Assistant George A. Fairfield, under instructions from Assistant C. O. Boutelle, determined the difference of level of the tide-gauges at Wood's Hole, Quicks' Hole, Tarpaulin and Kettle coves in Buzzard's bay and Martha's Vineyard sound, at which observations were made during the season by the hydrographic party of Lieut. Com. Woodhull. Permanent bench-marks were made at all these stations, on rocks lying very near the points at which the gauges were kept.

The examinations called for by the Light-house Board under the act of Congress previously referred to, within the limits assigned to the hydrographic party of Lieut. Com. Maxwell Woodhull, were:

1. For a light-house at the easterly end of a thoroughfare between North Haven and Vinal Haven, or on Herring Neck, Maine.

2. For the erection of a harbor light on a point of land lying west of the entrance of Buck's harbor, in Brooksville, Maine.

3. For the erection of beacons, buoys, and spindles, between Owl's Head and Whitehead light-houses, and through Muscle Ridge channel.

The report of Lieut. Com. Woodhull upon these objects, and his recommendations upon them and others not provided for by law, were transmitted by me to the department on the 26th of October, 1852, and may be seen in Appendix No. 35.

Tides.—Besides the special observations before referred to, the times and heights of high and low water were regularly observed at Boston dry-dock station, and self-registering gauges were kept in operation at Portsmouth and Portland for one lunation.

Views.—Lieut. A. A. Gibson, U. S. Army, assistant in the Coast Survey, after taking the views in Section V, of Charleston harbor, &c., joined Lieut. George H. Preble, U. S. Navy, assistant in Coast Survey, in command of schooner "Gallatin," and during the month of September took views of the north and south entrances

to Wood's and Quicks' Holes, east entrance to Vineyard sound, Holmes's Hole, Tarpaulin cove, Mattapoissett and Sippican harbors, and of Muskeget channel, Billingsgate light, including Wellfleet, and seven views of Boston harbor.

The office work of reducing computations, duplicating, &c., the work of the last season, of all the parties employed in this section, has been brought up in the interval before taking the field again.

While occupied in this section I communicated personally with the chiefs of parties to ascertain the progress of their work, and to give the contingent directions required by the circumstances of the season.

SECTION II.—FROM POINT JUDITH TO CAPE HENLOPEN, INCLUDING THE COAST OF CONNECTICUT, NEW YORK, NEW JERSEY, PENNSYLVANIA, AND DELAWARE. (SKETCH B.)

In this section, the chief body of the field-work of which is finished, five parties have been engaged during a portion of the season—one in making astronomical and magnetic observations, one in triangulation, one in topography, and two in hydrography. Observations for latitude, azimuth, and magnetic variation, dip and intensity, have been made at one point; the triangulation of the Hudson river has been continued northward; examinations of Hell Gate have been made to ascertain the changes produced by the blasting the rocks in that channel; a survey has been made of Sandy Hook to note its changes; and a revision of the hydrography of the entrance to Dona and Mahon rivers, Delaware, has been made. The drawing and engraving of the following charts and sketches have been in progress: Long Island sound No. 1, mouth of Connecticut river, and south side of Long Island Nos. 2 and 3. The general coast chart from Gay Head to Cape Henlopen, the chart of Hell Gate, the sketch of changes at Sandy Hook, and the light-house sketch of New York harbor, have been published since my last annual report.

Astronomical observations.—Observations for latitude, azimuth, and time, and for magnetic dip, variation, horizontal and total intensity, were made at one station in this section, (Mount Rose, near Princeton, New Jersey) by Assistant J. E. Hilgard. The station was occupied from about the middle of July to the end of August; seventy-seven determinations were obtained for latitude with zenith telescope (C. S. No. 4,) on twenty-four pairs of stars from the Greenwich twelve-year catalogue. For azimuth five eastern and five western elongations of Polaris were taken with the two-foot theodolite (C. S. No. 2)—in each set ten observations on the star and six on the mark. The time results in connexion with the above were obtained with the same theodolite used as a transit.

The magnetic observations were as follows: Three sets for dip and two for total intensity, with a ten-inch Barrow dip-circle, (C. S. No. 26) and two complete sets for horizontal intensity, and three days' observation for variation, with declinometer (C. S. No. 2.) Mr. Hilgard was assisted in his observations, and the computations which were made as the work advanced, by Mr. G. W. Stevens.

Triangulation.—The triangulation of the Hudson river has advanced to the north to above West Point. (See Sketch B.) This operation has been under the charge of Assistant Edmund Blunt, who commenced the work on the completion of that in Section III, lower part of Chesapeake bay, in September. Mr. Blunt

was assisted during a part of the season by Lieut. W. R. Palmer, Topographical Engineers, and Assistant W. E. Greenwell, and during the whole season by Lieut. A. H. Seward, U. S. Army, assistant in Coast Survey, and Mr. C. B. Baker. In September Lieut. Palmer left the party to join that of Assistant C. O. Boutelle, in Maine.

Mr. Greenwell, who had been attached to the party for the purpose of becoming more familiar with this branch of the work, left it in October, to make the necessary arrangements for taking the field in Section VIII, to continue there his work of the last season.

Mr. Blunt commenced operations on the 13th of September, and closed there on the 10th of November. In their execution 1,930 observations upon thirty-seven stations were made, seven stations were occupied, and the area covered by it amounts to fifty-eight miles.

Since the close of the field operations of this party, it has been engaged in office-work, making the computation, duplication, &c., of the season's work.

Topography.—A resurvey of Sandy Hook was made in November, 1851, (see Sketch B,) to determine the changes of shore-line from the Ocean House northward, and six marble blocks were placed at points selected with reference to the facility of repeating this survey for future comparison. No especially new features were presented in the shore-line; but Assistant Whiting, who made a former survey of the Hook, calls attention to the fact of the washing away of the beach opposite the "Highlands of Navesink," which, as was anticipated in his report of the survey of 1850, indicates that a new inlet will probably open somewhere in this part of the beach.

This resurvey was made by Mr. R. M. Bache, under the direction of Assistant H. L. Whiting.

Hydrography.—Before commencing the season's work in Section I, Lieut. Com. M. Woodhull, U. S. Navy, assistant in the Coast Survey, made a resurvey of a portion of Dona and Mahon rivers, Delaware, and cross-sounded the Joe Flogger shoal. (See Sketch B.) This resurvey shows the bar at Dona river has from one foot to one foot and six inches more water on it at mean low water than Mahon River bar. About 3,000 soundings were made in each of these rivers, and between 5,000 and 6,000 on the bars and "Joe Flogger Shoal."

Buoys were placed, by direction of the Treasury Department, in Fire Island inlet, by Lieut. George H. Preble, U. S. Navy, under the immediate direction of Lieut. Com. Woodhull. His report is in the Appendix, No. 38.

The report of Lieut. Bartlett, U. S. Navy, of his last examination of Pot Rock, together with a correction made in consequence of the resurveys of Major Fraser, will be found in the Appendix, Nos. 8 and 9. There is now, according to the latest information we possess, rather more than nineteen feet on the highest part of this rock at mean low water, the points only projecting above the plane of twenty feet. The results accomplished there have been worth to navigation many times the expenditure made.

SECTION III.—FROM CAPE HENLOPEN TO CAPE HENRY, INCLUDING THE COAST OF DELAWARE, MARYLAND, AND PART OF VIRGINIA. (Sketch C.)

There have been eleven parties at work during parts of the season in this section—two making astronomical observations; three executing main and secondary triangulations and reconnaissance; four topography, one being a double party; and two hydrography, one being a double party, with a steamer and a sailing-vessel. Astronomical observations have been made at two points in this section; the difference of longitude between Washington and Petersburg, Virginia, has been determined by telegraph. The primary and secondary triangulations of the outer coast of Virginia have been continued to its connexion with that of Chesapeake bay, on Smith's island, at Cape Charles. The secondary triangulation of the Appomattox river, from Petersburg to its mouth, has been executed, and that of the James river has been commenced. Work of revision of topography on the east side of Patapsco river has been executed; that of the main shores of Chesapeake bay has been completed, with the exception of fifteen miles, to Cape Charles. Two more seasons will probably complete this part of the work, with the bays adjacent, including Hampton roads. The hydrography of the ocean coast has reached Prout's island, (Matchipungo inlet,) within a season's work of the extremity of the peninsula.

The drawing and engraving of sheets Nos. 1, 2, and 3, scales $\frac{1}{80,000}$ and $\frac{1}{400,000}$, Patapsco river, Appomattox river, and seacoast of Delaware and Maryland, are in progress, and the charts and sketches of Chincoteague shoals, Fishing or Donoho's Battery, and entrance to Chesapeake bay, have been published.

Examination for a light-house at Pungoteague creek, near Pocomoke sound, was made.

Astronomical observations, &c.—The observations for difference of longitude by telegraph in this section have been made by myself, assisted by Assistant L. F. Pourtales and Sub-Assistant George W. Dean. The purpose, besides the immediate one, was to examine the influence of the different circumstances producing errors in the longitude determinations by this method.

The difference of longitude between Seaton station, Washington, and Roslyn station, near Petersburg, Virginia, was determined by observations made on six nights between July 3 and August 7. The telegraphic connexion between the two stations was made by constructing about half a mile of telegraph line from the Roslyn observatory to join the Washington and Petersburg telegraph line, which is connected with Seaton station in Washington, the connecting wire having been kindly loaned by the superintendent of the line. In determining this difference of longitude, one hundred and twenty-four observations were made upon thirty-five zenith stars; eighteen observations for collimation, and nine for equatorial intervals, were made upon three circumpolar stars. In connexion with the above operations one hundred and twenty-two observations upon twelve stars were made for local time. The instrument used was a forty-three-inch transit instrument, Troughton and Simms, (No. 8, U. S. C. S.) The diaphragm consisted of twenty-five wires arranged in groups of five. The use of the telegraphic line was given after half-

past nine o'clock p. m., free of charge, through the liberality of Elam Alexander, esq., President of the New Orleans and Washington Telegraph Company, and every facility was afforded by all connected with the company for the successful execution of these observations. Messrs. Dowell and Waddell, operators in the office at Petersburg, and Mr. Colton, in Washington, gave very prompt and satisfactory assistance in prosecuting these operations.

For azimuth five sets of observations were made on Polaris at culmination, and five sets at elongation, by Lieut. Trowbridge and myself, and a verification angle measured for the triangulation, the azimuth being referred to Finn's signal of the triangulation. The thirty-inch theodolite (C. S. No. 1) was used in these observations.

For latitude, one hundred and eleven observations upon sixty stars, selected from the Greenwich twelve-year catalogue, were made at Roslyn station, with forty-nine-inch zenith telescope, No. 5 U. S. C. S., (Würdeman,) and one hundred and thirty-five observations were made upon Polaris at eastern elongation for value of micrometer.

Fifteen moon culminations were observed at Seaton station, from the twentieth of February to the third of June, and nine from July first to October fifteenth. In connexion with these, one hundred and fifty-one transits of stars were observed. All the observations were with a diaphragm of twenty-five wires, and previous to June recorded on the Saxton register, and after that on the spring governor. The observations were made by Assistant L. F. Pourtales, aided by Mr. J. C. Langton.

At Roslyn station, eighty observations for magnetic declination on five different days, and four sets of deflection and vibration on three different days, were made with the declinometer D. 22, Jones (C. S. No. 1.) The observations for dip were made with ten-inch dip circle, Barrow & Co. (C. S. No. 4.) These magnetic observations were made by Sub-Assistant George W. Dean, aided by Mr. D. Trueheart.

Permanent meridian marks, in connexion with Roslyn station, (the property of Stephen Finn, esq.,) were made by Mr. Dean, at the request of the committee of the city council, on the southern side of the Appomattox, on the hill east of the city, and near Mr. Russell's. These will serve for the determination of changes in the magnetic variation, and will enable surveyors to refer their compass lines to the true meridian.

The computations of these observations by Mr. Pourtales, give Petersburg east of Washington $1^m\ 35^s.603$, with a probable error of $\pm\ 0^s.009$. The probable error of a single set of observations of a star over fifteen wires is $\pm\ 0^s.081$. The residual probable error of a single night's work, with the transits of fifteen stars telegraphed from and received at both stations, not accounted for by the error of tapping and receiving, is but $0^s.004$, or may be considered insensible, so that the multiplication of the number of nights of observation is unnecessary. The wave time given by these experiments is lower than that of any former ones, being but 9,800 miles per second. The personal equation between Mr. Dean and myself was small, as has hitherto been considered, but of both with Mr. Pourtales was nearly $0^s.15$.

Primary triangulation.—The primary triangulation down the Chesapeake, and the secondary connected with it, were continued by Assistant Edmund Blunt, during the months of July and August; four primary and fourteen secondary stations were occupied, and 2,109 angles observed with twelve-inch theodolite, Troughton and Simms, (C. S. No. 23,) upon six primary and thirty-six secondary objects. The area covered by the work amounted to one hundred and seventy-one square miles. This work has been closed upon the stations at the Capes, (see Sketch C, No. 1,) and it is expected that a portion of next season will suffice for its completion and that of the adjacent bays.

Secondary triangulation.—The secondary triangulation of the outer coast of Maryland and Virginia has been continued by Assistant John Farley, and has now been brought to a junction with the points of the Chesapeake triangulation on Smith's island, at Cape Charles, (see Sketch C, No. 1;) a few observations for verification and closing are only required, which Mr. Farley is now making, having taken the field again, early in October, for that purpose. Since the date of my last annual report, fifty angles from ten stations, and on twenty-five objects with one thousand intersections, have been observed in the prosecution of this work: the area of the triangles is about one hunded and thirty-three square miles.

Mr. Farley was also engaged in making the scheme of a triangulation of the Appomattox river, Virginia, required from the head of tide-water, above Petersburg, to its junction with the James river at City Point. (See Sketch C, No. 1.) A preliminary base of 1,580 metres was measured and reconnaissance for the triangulation made, when the party was turned over to Lieut. W. P. Trowbridge, Corps of Engineers, assistant in the Coast Survey, who completed the reconnaissance and measurements required for the work on the 14th of August. The statistics of the triangulation are thus given:

Number of stations occupied.	Number of objects observed upon.	Number of angles measured.	Number of sets.	Number of observations. D. and R.	Square miles.
20	123	86	255 Of 6 repetitions. In series.....	1,530 325	8.64
			Total.....	1,855 D 1,855 R	
				3,710	

The measurement of the angles was generally made by Mr. Edward Goodfellow, who assisted Lieut. Trowbridge.

Topography.—After October 1, the date of their last annual report, to November 24, the topography of the eastern shore of the Chesapeake was continued by Sub-Assistants John Seib and S. A. Wainwright, embracing the locality of Pocomoke sound, plane-table sheets Nos. 37 and 45, (see Sketch C, No. 1,) and Wicomico river, sheet No. 40. The amount of work executed during that time is thus stated:

Shore-line - - - - - - - - - -	77 miles.
Roads - - - - - - - - - -	8 "
Area - - - - - - - - - -	19 "

Assistant J. B. Glück was engaged until December, after the date of my last report, in the revision of the topography east side of Patapsco river, (see Sketch C, No. 1,) contained in the harbor chart, and executed five square miles, twelve miles of shore-line, and fifteen miles of roads on that sheet. The work was discontinued on account of the severity of the season and the illness of Mr. Glück. This work was resumed by Assistant H. L. Whiting, and continued by him, aided by Mr. Boschke, until the season for operations in Section I, when the party was transferred to that section. In the prosecution of this work thirty-one and a half miles of shore-line, thirty-six miles of road—twelve and a half square miles—were surveyed.

Assistant J. B. Glück, who fell a victim to the disease which had forced him from the field, was one of the most accomplished topographers of the Coast Survey, excelling especially in the delineation of broken ground, complicated by accidents of the surface. His zeal, energy, activity, and resource made him an exceedingly valuable officer, while his amiable and social qualities endeared him to his comrades, and attracted the regard of all whom he met. The officers of the Survey have placed on record their opinions of the value of his services, their expression of regard, and of condolence with his family. (See Appendix No. 30.)

Mr. Whiting also determined the position of a sunken vessel in Hooper's straits by intersections from three positions on shore.

Mr. Whiting is now engaged in inking the sheets of his work in this and Section V.

The double party of Sub-Assistants Seib and Wainwright commenced the topography of the Appomattox river at Petersburg, (see Sketch C, No. 1,) on the nineteenth of May, and continued it towards its mouth as fast as the triangulation party could furnish points. All the shore-line being furnished to the hydrographic party, and sickness prevailing among the party, the filling in of a small remaining portion of the interior work was postponed to a more healthy season, and on the fifteenth of August the operations of this party were transferred to the eastern shore of Chesapeake bay. The topography of the Appomattox is very intricate, the river being very narrow, branching often, and forming a number of small islands, whose shores are lined with thick bushes, and which are in many cases covered with woods. The work on Chesapeake bay, up to October 1st, embraced the shore-line of plane-table sheets Nos. 55, 56, 57, 58, and 59, and a considerable portion of the interior. This includes the line from Wolftrap to New Point Comfort, and from Back river to Cape Henry on the west side, and from Rose Mary to Cape Charles on the east side. The topography of the main shore of the Chesapeake (see Sketch C, No. 1) is now complete, with the exception of the position between New Point Comfort and Back river light-house, (plane-table sheets Nos. 52 and 53.) Mr. Edward Goodfellow joined this party after the completion of the triangulation of the Appomattox river, and acted as aid. The amount of work executed during the season is shown by the following:

Shore-line	117	miles.
Roads	36	"
Area	16½	"

This includes the towns of Petersburg and Blanford. Mr. Seib is now under instructions to execute revision of topography of Cove Point, Patuxent river, and then fill in the interior of the topography of the Appomattox, postponed in the early part of the season.

Assistant George D. Wise has furnished to the hydrographic party, during the season, the beach-line and intermediate inlets, with the exception of fifteen miles, from South Gargathy to Cape Charles, (see Sketch C, No. 1,) on the outer coast of Virginia, and has made a complete survey of Cape Charles. Mr. Wise has also been engaged in filling in the topography on the sheet from South Gargathy to below Metomkin inlet, which he expects to finish before the close of the season. Up to the first of October his work of this season includes an area of forty-two square miles, ninety-three miles of shore-line, and twenty-one miles of roads.

Hydrography.—Lieut. Com. J. J. Almy, U. S. Navy, assistant in the Coast Survey, with the steamer Hetzel and schooner Graham, has continued the hydrography of the seacoast of Virginia, from South Gargathy to north point of Prout's island, (see Sketch C, No. 1,) a distance of twenty-six nautical miles. In executing this work, 1,506 nautical miles were run in soundings, 25,881 soundings made, 337 square miles in area sounded out, 4,178 angles were measured with theodolites, and 2,427 with sextant. Forty-three flood and thirty-nine ebb tides were observed by this party. Besides making these outside soundings, Lieut. Almy has also sounded out Metomkin, Watchaprigue, and Great Matchipungo inlets. This latter inlet was found to be the best harbor between the capes of the Chesapeake and of the Delaware. It has a fine wide channel, with eleven feet water on the bar at low water, and fourteen feet at high water, with sufficient room inside for anchorage of one hundred vessels, in from two to eight fathoms water. Matchipungo inlet was also found to have two tolerably good channels leading into it—one from the northward, with seven feet at low tide, and the other from eastward, with also seven feet at low tide.

The soundings were brought down at a uniform distance of twelve and a half miles from shore, and in some instances at a distance of fifteen miles from the shore. Directly due east of Dawson's triangulation point, north end of Paramore's island, at a distance of five and a half miles from shore, a shoal of half a mile in extent was discovered, with only four fathoms water on it; around it the soundings were nine fathoms.

By a resurvey of Chincoteague shoals, (see Sketch C, No. 2,) it has been discovered that the direction of the channel and form of the shoals have somewhat changed since the last year, and it is represented that some change is almost always effected by a series of easterly storms. An examination of Metomkin inlet, with reference to the location of beacons, &c., (see Appendix No. 40,) disclosed the fact that the water in this inlet had been gradually shoaling during the season, and now the least depth is eight feet, whereas last season it was found to be eleven feet.

The operations of this party were transferred in the month of September to the execution of the hydrography in Chesapeake bay, joining the work of Lieut. Com. Sands of last year, between Capes Charles and Henry, (see Sketch C, No. 1,) and

extending up the bay as far as Upshur triangulation station. The number of nautical miles run in soundings was 1,169; and of soundings taken, 35,141. The area sounded out was two hundred and forty square miles; and number of angles taken by theodolite 558, and by sextant 2,770. The number of tides observed was 67; and the number of observations taken, 1,116.

Lieut. Com. Almy says: "In executing this work it has included a most important and dangerous shoal, termed the Inner Middle, the shoal part of the middle ground, where there is only three feet water, almost always breaking, and is the terror of vessels navigating this part of the bay. It borders upon and is to the westward of the north channel, is about two miles in length, half a mile in width, with from three to nine feet water upon it; vessels are very often wrecked upon it. Lieut. Sands sounded, last year, a portion of the outer middle ground, the least water that he was upon being ten feet."

In connexion with the other operations on the Appomattox river, Lieut. Com. Wainwright's party was transferred on the twenty-fifth of June from Section IV to execute the hydrography of the river. (See Sketch C, No. 1.) Numerous borings were made on the various bars in the river to a depth of six feet below their surface, and their character ascertained to be coarse, yellow sand and pebbles, and mud. Tide-gauges were kept at different points on the river, from its mouth to Petersburg, which were connected by a line of levels. The average rise and fall of the tide was about three feet. Current stations were occupied at different points in the river, and the observations showed a decrease of the rate of the current from one mile per hour at the lower stations, to one-fourth of a mile per hour off the town.

A hydrographic reconnaissance of Harrison's bar, in the James river, (see Sketch C, No. 1,) was also made, and borings on it showed its surface to be composed of gray sand, with large pebbles and stones, and to six feet below of sand and mud mixed.

In the execution of this work twenty-seven thousand three hundred and sixty-one casts of the lead were taken, two hundred and seventy-seven angles measured, and ninety-four miles of soundings run.

The office-work of this party has consisted in reducing the soundings of their season's work, and they have turned in the hydrographic sheets of the Appomattox and Harrison's bar complete. They are now engaged in the reduction of the sheets of their season's work in Section IV, and of the tidal and current observations, after completing which they will proceed to the James river.

In Appendix No. 40 will be found the report of Lieut. Com. J. J. Almy upon the location of buoys at Metomkin inlet, outer coast of Virginia; and in Appendix No. 42 will be found a report, by the same officer, of an examination into the necessity and site for the location of a light-house at Pungoteague creek, Pocomoke sound. Lieut. Com. Wainwright made examination and recommendation upon the necessity and location of buoys in the James river, which will be found in Appendix No. 43.

During the season I inspected personally the operations in the Appomattox river, and examined the James river in reference to the work to be undertaken there.

SECTION IV.—FROM CAPE HENRY TO CAPE FEAR, INCLUDING PART OF VIRGINIA AND NORTH CAROLINA. (SKETCH D.)

During the season six parties have been employed in this section—one in reconnaissance, one in triangulation, one in triangulation and topography combined, one in topography, and two in hydrography. A minute reconnaissance for the triangulation of this coast has been carried from the present limit of the triangulation northward to Cape Henry, on the Virginia line; the triangulation of Core sound, commencing at the base at Beaufort, North Carolina, has been extended towards, and nearly completed to a junction with, the triangulation of last year of Ocracoke inlet. A reconnaissance of the channel through Core sound was made, which showed that very little change had taken place since the survey of the topographical engineers in 1837. The topography of the lower part of Currituck sound and Counjock bay and its islands has been continued to embrace all the triangulation, and that of the outer coast, from the lower extremity of Bodie's island to Garr island, and of Nag's Head, has been excuted. The hydrography of the bars of Cape Fear river has been completed, commencing at the southern point of Cape Fear, and extending beyond New inlet, and soundings at a distance of from two and a half to three and a half miles from shore. A hydrographic reconnaissance of New River bar has also been made. The hydrography of Roanoke sound was resumed at its limit of last year, and continued south of Bodie's island light-house. Surveys of Ocracoke and Hatteras inlets and Portsmouth bank have also been made.

Reconnaissance.—A reconnaissance of the coast of this section, from Cape Henry, the limit of Section III, south to the triangulation now executed, (see Sketch D, No. 1,) has been made by Brevet Major Henry Prince, U. S. Army, assistant in the Coast Survey. This examination was carried over the waters of Back bay, the northern part of Currituck sound, which extends, with a width of about three miles, to within thirteen miles of Cape Henry light-house, where a series of ponds commences, and extends, with intervals of sand-hills and narrow strips of land, to within four miles of the light-house, the whole distance presenting an equally favorable range of openings for the continuation of the triangulation. A general reconnaissance of the outer coast from New inlet, Cape Fear, to New river, was also made by the same officer, and a similar reconnaissance commenced south of the Cape Fear river.

On the close of the season in this section, Major Prince proceeded to Section I, and there continued the reconnaissance, with Assistant C. O. Boutelle, for the extension of the primary triangulation towards the northeastern boundary of the United States.

Triangulation.—Sub-Assistant A. S. Wadsworth, after giving transportation to the topographical party, in the schooner Bancroft, to Cape Hatteras, left it there and proceeded to Beaufort harbor, where he commenced his triangulation on the base measured by Assistant C. P. Bolles, and continued it over Core sound, northward, to within nine miles of the limits of his last season's work at Ocracoke inlet, (see Sketch D, Nos. 1 and 3,) and as far as the means allowed him and the

advance of the season permitted. This triangulation covers an area of one hundred and ten square miles, and in its execution twenty-eight stations were occupied, and eighty-eight angles measured, by four thousand one hundred observations with a six-inch Gambey theodolite, (C. S. No. 29.) The hydrographic reconnaissance of Core sound, already referred to, was made by this party.

On finishing the triangulation of Core sound, Mr. Wadsworth closed operations; and after the completion of the computations, reductions, &c., of his work, proceeded to join Assistant H. L. Whiting, to aid him in his topographical work at Cape Ann, Massachusetts, Section I. Since the close of Mr. Whiting's operations, he has been engaged in office-work, making projections, &c., preparatory to resuming his survey in Section IV.

Topography—There have been at work in this section two topographical parties; one under charge of Assistant J. J. S. Hassler, and the other under the charge of Sub-Assistant I. H. Adams. The operations of the party under the charge of Mr. Hassler have embraced the shores of Currituck sound, Counjock bay and its islands, and covered the limits of his own triangulation in that vicinity. (See Sketch D, No. 1.) The extreme cold of the last season, and driving winds, freezing and changing the position of the water in the sound, presented considerable obstacles to the progress of the work.

The number of miles of shore-line surveyed by this party was ninety-eight, and the area covered forty-five square miles.

Since the close of Mr. Hassler's operations in August, he has been engaged in plotting sheet No. 381 and the one lying immediately north of it, inking No. 381 for the office, and copying the journals and reviewing computations of his triangulation of last year.

The topography executed by the party under the charge of Sub-Assistant I. H. Adams embraced three localities on the outer coast of this section. The principal work of the season extended from the lower part of Bodie's island along the coast to Garr island. (See Sketch D, No. 1.) Many changes were discovered in the positions of signals, woods, &c., from last year. The signal at Cove Point, established in 1851, at high-water mark, was found to be 100 metres in the ocean. Woods which existed have been choked by the sand drifted by the wind and water, and destroyed, leaving the beach bare or covered with dead stumps, where it was before well wooded. After the execution of this part of the work, Mr. Adams proceeded to Nag's Head, and there completed an unfinished sheet of Mr. Hassler; which done, he repaired to Ocracoke and Hatteras inlets, (see Sketch D, Nos. 1, 3, and 5,) and gave the shore-lines of those vicinities to the hydrographic party engaged there, under the command of Lieut. R. Wainwright, U. S. Navy, assistant in the Coast Survey.

The work of the season of this party is thus summed up:

Amount of shore-line surveyed - - - - - -	155 miles.
Amount of area surveyed - - - - - - -	150 "

Since the close of these operations, Mr. Adams has been engaged in inking his sheets, which he has completed, and in making his preparations for taking the field in Section VI, during the coming season.

Hydrography.—The hydrography in this section has been continued by two parties during part of the season. Lieut. Com. J. N. Maffitt, U. S. Navy, assistant in the Coast Survey, in command of the schooner Gallatin, has executed the soundings of the bar of the Cape Fear river, commencing at the most southern point of Cape Fear, extending at a distance of from two and a half to three and a half miles from shore to the northward and westward, including the main bar, middle ground, and western bar, the river up to New inlet, that bar, and the Sheep's Head ledge. (See Sketch D, Nos. 3 and 4.)

In the execution of this work, 25,688 soundings were made, 18,010 angles measured, and 389 miles of soundings run; thirty-five specimens of bottoms were preserved, and fifteen observations of currents made. After this work was completed, Lieut. Com. Maffitt proceeded to make a hydrographic reconnaissance of New River bars, (see Sketch D, No. 4,) and of the river above the obstructions. In making this reconnaissance, 5,870 soundings were made, 481 angles measured, and fifty miles of soundings run.

The hydrography of Roanoke sound was resumed where it was left off last year, by Lieut. Com. Richard Wainwright, U. S. Navy, assistant in the Coast Survey, and continued to some distance below Bodie's Island light-house. (See Sketch D, No. 1.) Hatteras and Ocracoke inlets, and Core bank, were also surveyed by the same party. (See Sketch D, Nos. 3 and 5.) Of the channels of Hatteras inlet, Lieut. Com. Wainwright says: "The channel supposed to be opening at Hatteras inlet when Lieut. Com. Jenkins made his reconnaissance, in November, 1850, has since opened, and is in more general use than the old one; the water is the same on both bars, the advantage being that the new channel is straighter." The number of soundings taken in the execution of this work was 21,788, the shore-line run 111 miles, and 1,196 angles measured.

About the middle of June, the operations of this party in this section being closed, Lieut. Com. Wainwright was charged with the execution of the hydrography of the Appomattox river, from Petersburg, Virginia, to its junction with the James river, (see Sketch C, No. 1,) and with a hydrographic reconnaissance of Harrison's bar, in James river. This was completed about the ninth of August; since which the party has been engaged in the reduction of Ocracoke and Hatteras inlets sheets, and the sheets of their work in Section III. All their work was copied in duplicate.

On his return from Section V, after completing the survey of the Cape Roman shoals, South Carolina, Lieut. Com. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, was charged with the placing of the Hatteras bell-beacon on outer Hatteras shoals, and of the buoy on Diamond shoals. The above beacon and buoy were recommended by Lieut. Com. T. A. Jenkins, U. S. Navy, assistant in the Coast Survey, (who made the survey of the Hatteras outer shoals,) in his report to me of November 11th, 1850, published in the annual report of that year, in Appendix No. 15 *bis*. His recommendation was adopted, and an appropriation made for the beacon, which was constructed by the Messrs. Merrick, of Philadelphia, upon a plan designed and furnished by Lieut. Com. Jenkins. The bell-beacon was delivered at Norfolk, Virginia, whence it was towed, by Lieut. Com. Craven,

to the Hatteras shoals, and on the 24th of November he succeeded in mooring it in its proper position, in four fathoms water, nine miles NNW. from Hatteras light-house, inside of the easternmost shoal.

The particulars of the execution of this duty are given in the reports of Lieut. Craven, appended. (Appendix No. 44 *bis.*)

A notice of the locating of this beacon, and of the buoy on Diamond shoals, has been published for the benefit of mariners by the Light-house Board.

SECTION V.—FROM CAPE FEAR TO THE ST. MARY'S RIVER, INCLUDING THE COAST OF THE STATES OF SOUTH CAROLINA AND GEORGIA. (SKETCH E.)

The observations for difference of longitude by telegraph between Charleston and Savannah, referred to in my last report, were completed in the spring of 1852. Three stations have been occupied for the extension of the primary triangulation between the base on Edisto and the city of Charleston. Observations have been made on lines extending over the Edisto, Kiawah, Dawho, and Wadmelaw rivers, and Edisto, Wadmelaw, and Kiawah islands, and the reconnaissance for its further extension over John's island has been made. The secondary triangulation, in connexion with this, has embraced all the vicinity between the primary points occupied, and has furnished points for the topographical work between Edisto and Charleston. Magnetic observations of intensity and declination were made on Tybee island and opposite Savannah. The triangulation of the Savannah river has been extended down the river to Fort Pulaski, and above Hutchinson's island, over Argyle and Isla islands. The topography of the shores of the Savannah river has been executed within the same limits. The hydrography of Savannah river has been completed from Fort Pulaski to a point fourteen miles above the city, and current and tidal observations at many points of the river have been made.*

Re-surveys of the several channels into Charleston harbor, for the purpose of ascertaining the changes produced by storms, &c., have been made, and borings were made on the bar, specimens of which, and of the water taken at every hour of ebb and flood, were bottled and carefully preserved.

The operations in this section were continued until the end of May, but it is clearly established that it is not advisable to keep the land parties at work, as a general rule, beyond the first of that month. The heat affecting the atmosphere was such as to render it not at all suitable for observations.

The number of parties employed in this section during the season was five—one in primary and secondary triangulation, one in secondary triangulation, one in topography, one in hydrography, and one in making magnetic observations.

Several views of Charleston harbor, for that chart, were taken.

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* I made an examination of the Savannah river in the spring of 1852, and arranged the operations of the several parties there so as to insure the completion of the work during the remnant of the season which remained. The exertions of Assistants Whiting and Bolles, and of Lieut. Com. Maffitt, were unremitting and were crowned with success. By the co-operation of these parties, and of Major Stevens, assistant in charge of the office, the complete surveys and maps of the river to the head of Argyle island were ready when the commission for preparing plans for its improvement was organized.

A reconnaissance of the entrance of Georgetown harbor was made, and an examination and report on light-houses and other aids to navigation.

Primary triangulation, and secondary connected with it.—The party for this work was under the charge of Assistant C. O. Boutelle, aided by Sub-Assistant J. W. Gregorie, and by Mr. Benjamin Huger, jr. The earlier part of the season was occupied in the continuation of the secondary triangulation between Edisto base and the city of Charleston. (See Sketch E, No. 1.) The first primary station on Jehossee island was commenced about the end of February, but the weather was so unfavorable that it was not completed before the arrangements made in reference to transportation required a transfer of the party to New-Cut station, where the regular observations for azimuth and for horizontal angles in the triangles were made. The two-feet theodolite (C. S. No. 2) was used for azimuths, observations being made at fourteen elongations of Polaris and Delta *Ursæ Minoris*, and three hundred and twenty-nine observations on the star and mark. The time was noted by a mean-time Kessel's chronometer, (C. S. No. 1285.) A set of five vertical wires was placed in a ten-inch Gambey theodolite, (C. S. No. 43,) and it was used as a transit, taking thirty transits on eleven nights. The same ten-inch Gambey, (C. S. No. 43,) mounted upon a scaffold forty-six feet high, was used for measuring the horizontal angles. After finishing New-Cut station the party proceeded to Elliott's cut, on the twenty-fifth of April, and occupied that station; which being completed, the reconnaissance for the secondary triangulation was prosecuted until the twentieth of May, when the operations were closed.

The secondary work in connexion with the foregoing, chiefly executed by Sub-Assistant J. W. Gregorie, covers the North Edisto, Dawho, Wadmelaw, Kiawah, and Folly Island rivers. (See Sketch E, Nos. 1 and 3.) The instruments used were a ten-inch Gambey theodolite, (C. S. No. 43,) and a six-inch, (C. S. No. 13.) Thirty-seven stations were occupied—fourteen by Mr. Boutelle, and twenty-three by Mr. Gregorie—and four hundred and fifty-seven angles measured upon four hundred and fourteen objects, by four thousand and ninety-two observations.

Magnetic observations.—On his way from Section VIII, Assistant Julius E. Hilgard stopped at Savannah to make observations for magnetic declination and horizontal intensity. Observations were made at two stations—one opposite Savannah, and the other on Tybee island—with declinometer, (C. S. No. 22, Jones,) and a nine-inch Barrow dip-circle. At each of these stations three days' declination, three sets of dips, and two sets of observations for horizontal intensity, were made. Mr. Hilgard was assisted in this work by Mr. G. W. Bagwell.

Secondary triangulation.—Assistant C. P. Bolles, with the aid of Mr. J. R. Offley, carried the secondary triangulation of the Savannah river from the base below the city to Fort Pulaski, and from near the head of Hutchinson's island to the head of Argyle island. (See Sketch F, No. 2.) The operations of this party were closed about the tenth of May, when the party proceeded to North Carolina, to continue the triangulation of Cape Fear entrance, in Section IV. The season proved so unusually unhealthy, that it was found impracticable to commence this work until after the beginning of November.

Topography.—Assistant H. L. Whiting commenced this branch of the survey on Savannah river on the fifth of January, with the assistance of Mr. W. S. Walker, extending it above the city to the head of Isla island, and below to Fort Pulaski, which embraced the limits of the triangulation. (See Sketch E, No. 2.) These sheets, of which there were four, were made with great accuracy and care, and those near the city were very much in detail.

The work of the party closed on the 20th of May.

These sheets were on a scale of $\frac{1}{10,000}$; and one embracing the city, its wharves, and immediate vicinity, was made on a scale of $\frac{1}{5,000}$.

The amount of the season's work is thus summed up:

	Shore-line.	Low water.	Dikes.
Sheet No. 1, on $\frac{1}{5,000}$, from city to Four-mile Point - -	25	7	70
Sheet No. 2, on $\frac{1}{10,000}$, from No. 1 to Cross-tides - - - -	21½	4½	90
Sheet No. 3, on $\frac{1}{10,000}$, from Cross-tides to head Isla island -	66½	5	
Sheet No. 4, on $\frac{1}{10,000}$, from Four-mile Pt. to Fort Pulaski -	51½	13	4
	164½	29½	164

Area about eighty square miles.

The details in the city, with the streets, canal, railroad, &c., amount to some twelve miles more, their linear extent being difficult to state precisely.

Mr. Whiting gives a table of distances of certain points, to which some interest is attached. The table is given below:

Steamboat route from Exchange to head of Isla island - - -	12½ miles.
Length of front, from middle of Cross-tides to do - - - -	10¾ "
Length of middle, do do do - - - -	8½ "
Length of back, do do do - - - -	11 "
From middle of Cross-tides to buoy at Wrecks, by Front river channel way	7 "
Do do do by Back river do -	5¾ "
Length of cross-tides from middle of channel of Front and Back rivers -	1 1/10 "
Length of Hutchinson's island - - - - - - - -	5 "
Length of Argyle island - - - - - - - - -	5¾ "
Length of Isla island - - - - - - - - - -	3½ "
Ship-channel route from Exchange to Fort Pulaski - - - -	16½ "
Do do abeam of Tybee light - - - - -	19 "

Hydrography.—Two parties have been engaged in hydrography in this section during a part of the season; the one under the command of Lieut. Com. J. N. Maffitt, U. S. Navy, assistant in the Coast Survey, employed in the early part of the season in supplementary work in Charleston harbor, having proceeded to Savannah, and extended the hydrographic survey of that river from Fort Pulaski to Union creek, fourteen miles above the city, and as far as the shore-line had been determined by the topographical party. (See Sketch E, No. 2.) This survey was executed under the unfavorable circumstances of a season which was remarkably severe on all parts of the coast. Great care and attention were bestowed upon it in order to furnish the most accurate and reliable information in relation to the river. Current and tidal observations, at numerous points, were

carefully taken. The work in this river completed, Lieut. Com. Maffitt sailed for New York on the seventh of June, and there executed his instructions in reference to an exchange of the U. S. brig "Washington," and the U. S. revenue schooner "Crawford," leaving his own vessel, the schooner "Gallatin," in the charge of Lieut. George H. Preble, U. S. Navy, assistant in the Coast Survey, who was engaged in hydrography in Section I. On the third of July, the exchange of vessels having been made, Lieut. Com. Maffitt sailed, with the schooner "Crawford," for Charleston, and arrived there on the ninth, when he immediately commenced the re-survey of the North, Main, and Sullivan's Island channels, (see Sketch E, No. 2,) for the purpose of ascertaining the changes produced by storms, &c., and of making borings on the bar, which he succeeded in sinking to the depth of fifteen and fifteen and a half feet; specimens of every foot of which have been preserved, with specimens of water bottled at every hour of flood and ebb tides.

The work of this party in the harbor of Charleston and Savannah river is exhibited by the following:

Rattlesnake shoal and supplementary work, Charleston.

Number	of angles measured	776
Do	soundings taken	10,201
Do	miles of soundings run	271
Do	current observations made	56
Do	specimens of bottom taken	16

Savannah river.

Number	of angles observed	1,105
Do	soundings made	24,562
Do	miles of soundings run	393
Do	current observations	18

The office-work performed by this party has been, copying all the notes of the season's work; plotting current diagrams; two charts of Charleston harbor for the commission, on a scale of $\frac{1}{10,000}$; one section of Charleston bar, on a scale of $\frac{1}{5,000}$; thirty-four miles of Savannah river—twenty miles on a scale of $\frac{1}{5,000}$, and fourteen miles on a scale of $\frac{1}{10,000}$.

I cannot, in justice, omit the statement that the labors of this party have, in amount, as compared with means, in constancy, and in success, exceeded any which have yet come under my observation in the progress of the survey.

The other party, under the charge of Lieut. Com. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, in command of the steamer "Corwin," made a survey of Cape Roman shoals, South Carolina.

The following is an extract from his report:

"The shoals off Cape Roman are of a most dangerous character, being directly in the track of the southern coasting vessels; lying six miles from the light-house, and with water of such good depth on the seaward side as might

well deceive the most careful navigator. These shoals are one mile in extent, of crescent-shape, and trending NNE. and SSW. The light-house bears from the centre of the shoals NNW. per compass. The least water at low tide is six feet, and with moderate winds from NE. to W. there are no breakers to indicate the danger; but with winds from SW. around by the south to east, the 'breakers' generally show themselves. On the eastward or seaward side they are 'steep to,' shoaling from six fathoms to three fathoms, and then eight feet, in so many casts of the lead.

"There is a five-fathom bank outside of the shoals, but the distance across it is short. Strangers cannot trust to striking it, and should not venture into less than eight fathoms water.

"Inside of the shoals there is a good channel of fifteen feet, of which very few persons have been aware, and it is far wider than has been supposed by those even best acquainted with it. This channel is nearly two miles wide, shoaling very gradually on either side, and free from irregularities. The lowlands afford no good marks for the channel; it should be buoyed out.

"My work has discovered a good safe anchorage in northerly winds, to the southwest of Roman light-house, anchoring in not less than three fathoms; and also a good channel of not less than six feet at low water, from the southward to the harbor inside the cape.

"I carried my work inshore, to the continuous line of shoals which make out from the Santee river and Winyah bay soundings, close to the shoals, in two fathoms."

This work was commenced about the middle of September, and ended about the first of November; embraced an area of one hundred and twenty-five square miles; 723 miles of soundings run, and 17,565 soundings taken. The greatest depth of water sounded was nine fathoms, and the least was one. Two tidal stations were occupied. Upon the closing of this work, Lieut. Com. Craven proceeded to Hatteras outer shoals, to place the bell-beacon constructed for that situation, an account of which is given under the head of Section IV.

Views.—In June, Lieut. A. A. Gibson, U. S. Army, assistant in the Coast Survey, proceeded to Charleston, and took two views of that harbor for the chart, from positions selected on consultation with Lieut. Com. Maffitt.

Under the immediate direction of Lieut. Com. Maffitt, an examination into the necessity for beacons or range-lights in Georgetown harbor, South Carolina, as requested by the Light-house Board, was made by Passed Midshipman John P. Jones, U. S. Navy. My report, transmitting that of Mr. Jones, is given in the Appendix No. 45.

SECTIONS VI and VII.—FROM THE ST. MARY'S RIVER TO ST. JOSEPH'S BAY, COAST OF FLORIDA, AND INCLUDING THE FLORIDA REEFS AND KEYS, AND FROM ST. JOSEPH'S BAY TO MOBILE POINT. (SKETCHES F AND G.)

Five parties have been at work in these two sections during the whole or a portion of the season. A reconnaissance has been made from St. Joseph's bay to Cedar Keys, and the topography of the keys has been completed. The trian-

gulation of the reef and keys, and of the inner keys, has been continued as far south as Point Elizabeth and Barnes' key, and fifteen screw-pile signals have been erected at dangerous points on the reef, which cannot fail to be of use to navigators. The report of Lieut. James Totten, U. S. Army, (Appendix No. 14,) and the Sketch F, No. 1, give the details of the positions of these signals, which, in my judgment, should be made permanent, and improved as sea-marks. The hydrography of Key West harbor has been completed, and that of the reef carried from the northern extremity of the reef to Triumph reef. The interior hydrography of Key Biscayne, connected with this, has also been executed. Lieut. Com. Rogers reports a good harbor of refuge under Triumph reef, which he proposes to call Legaré harbor, (see Sketch F, No. 1,) and to mark by a suitable screw-pile signal, and by buoys. His recommendations are given in Appendix No. 11. A shoal was discovered by the same officer near Rebecca shoal. (See Appendix No. 10, and Sketch F, No. 1.)

Besides the sketches belonging to these sections, a preliminary chart of Key West harbor has been engraved. The hourly tidal observations made there have been reduced and discussed by myself personally, or under my immediate direction, by Mr. W. W. Gordon. They give most satisfactory results as to the law of the diurnal inequality. Hourly tidal observations have also been made for two lunations at Cedar Keys, and at St. George's island, near Appalachicola, by Mr. G. Würdeman. They have further been reduced and compared with those at Key West.

The observations of the direction and force of wind, taken in connexion with the tides, have been examined in like manner, and I propose to give the results in a form adapted to the use of navigators.

It is desirable that the work in Section VII should now go forward on a scale commensurate with that in the other sections; otherwise, it will be left so far behind, on the completion of the other parts of the coast, as to produce inconvenience. Section III has been carried so far forward that a portion of the means may perhaps be spared from it in a year more; but it would, in my opinion, be better to enlarge the general appropriation somewhat, to push this section forward. I have always entertained and expressed the opinion that the special appropriation for Section VI, including the reefs and keys, was inadequate to carry on the very important work there on a proper scale. In this opinion I have been fully sustained by the Treasury Department.

Reconnaissance, etc.—The portion of Section VII extending from Cedar Keys to St. Joseph's bay, including the main land, keys and reefs, has been embraced in a general reconnaissance of the Gulf coast, made by Assistant F. H. Gerdes. The results are embodied in a general sketch and a report, (Appendix No. 12,) which present the features of the main and islands, and a comprehensive view of the considerations which must enter into the schemes of triangulation. A special sketch of St. George's sound has also been furnished. A more detailed reconnaissance, based upon astronomical and trigonometrical determinations, and including soundings, was made of the St. Mark's river, harbor, and bar. Assistant Gerdes' report of this will be found in great part in Appendix No. 13. (See also

Sketch G, No. 3.) Assistant Gerdes has also been engaged not only in the secondary triangulation, topography, and special surveys of various localities, but in the selection of points for primary stations.

Astronomical and magnetic observations.—Assistant J. E. Hilgard was occupied during the months of February, March, and April, 1852, in these sections, with observations for latitude and azimuth, magnetic declination, dip, and horizontal intensity, and a chronometer expedition. His general report is briefly as follows:

"Observations for *longitude.* Twelve chronometers were carried from Charleston to Key West, Cedar Keys, and St. Mark's, and thence back to Key West and Charleston, to determine the difference of longitude between those places. For local time and rates 144 transits were observed, with C. S. transit No. 8, and the chronometers were compared by coincidences of beat every day from February 16 to April 29.

"Observations for *latitude* were made at the station on Depot Key or Asinaotee, Cedar Keys, and at St. Mark's, with zenith telescope No. 5. At the former station eighty-five observations were made on twenty-nine sets of stars, and at the latter twelve observations on eight pairs of stars, this being considered merely as a preliminary determination.

"Observations for *azimuth* were made with C. S. transit No. 8, by upper and lower culminations of circumpolar stars. At Depot Key the azimuth was determined by twelve sets of upper and lower culminations of Delta *Ursæ Minoris*, and fifty-one *Cephei*, with a probable error of $\pm 0^s.75$ for a single determination. The angle between the mark and station Seahorse Key was measured by sixty repetitions, with a twelve-inch Gambey repeating theodolite, C. S. No. 13. At St. Mark's, one upper and one lower culmination of Polaris was obtained, this determination being considered merely preliminary.

"Observations of *magnetic declination, dip, and horizontal intensity*, were made at Depot Key, with declinometer D. 22, by Jones, and a nine-inch Barrow dip-circle: for declination three days, for dip four sets, and for horizontal intensity two sets were observed.

"At St. Mark's light the magnetic declination was obtained by one day's observations."

Mr. Hilgard was assisted by Mr. G. H. Bagwell, who generally made the chronometer comparisons and took the declinometer readings. On his way in returning to the office, Assistant Hilgard made a series of magnetic observations in Section V, at Savannah, noticed under the proper head.

Triangulation.—Three assistants, with separate parties, have continued the triangulation, viz: Assistant F. H. Gerdes that of the Cedar Keys, (Section VII;) Lieut. James Totten, U. S. Army, assistant in the Coast Survey, the triangulation of the reef outside of Key Biscayne bay, (Section VI;) and Lieut. J. Swift Totten, U. S. Army, assistant in the Coast Survey, the inside triangulation from Key Biscayne to Key Largo, (Section VI.)

1. Assistant F. H. Gerdes, aided by Mr. George Oltmans, and during part of the season by Mr. Henry Ginder, continued the secondary triangulation, as well as the topographical survey of the Cedar Keys, in Section VII, (see Sketch

G, No. 2.) Suwannee reef on the north, Bird and Seahorse keys on the southeast, the lower part of Wacassassa bay on the south and west, with the adjacent mainland, embrace the area of the season's work. Eleven new signals were erected, ten others that had been destroyed by storms, etc., were replaced, two tripods and scaffolds were built, and observations made on fourteen stations, for 334 angles. The statistics of the topography executed by Mr. Gerdes will be given under the proper head.

2. Lieut. James Totten, U. S. Army, assistant in the Coast Survey, with the Coast Survey schooner Petrel, extended the outside triangulation of the reef in Section VI from Cape Florida to Point Elizabeth, about thirty-five miles south. (See Sketches F, No. 1 and No. 2.) The party left the field about the first of July. The statistics of the work are as follows:

Stations occupied, number of	22
Angles measured, "	191
Sets of observations, "	1,110
Single observations, "	6,644
Longest side of triangle	21,445.6 metres.
Shortest do do	541.5 "

The services of Lieut. Totten in the erection of signals along the reefs of this part of the coast, have been referred to in another connexion.

3. Lieut. J. Swift Totten, U. S. Army, assistant in the Coast Survey, aided by Sub-Assistant George A. Fairfield, and with the sloop Convoy, hired for the purpose, conducted the interior triangulation in Section VI, of which (see Sketches F, No. 1 and No. 2) Sands' Point and Black Point are the northern, and the station marked Barnes' the southern limits. The statistics of the season (January 17 to April 30) are as follows:

Main signals erected, 5; of 3d order, 16—in all	21
Main stations occupied, 5; of 3d order, 2—in all	7
Angles measured, by 3,096 measurements, and by 6,192 observations—516 sets of repetitions, 6 in each set	140
Longest side of main triangles	14 miles.
Shortest do do	3 "
Area of triangulation	125 square miles.

The three assistants above referred to, since their return from the Florida sections, have each been engaged in the computations of their several triangulations, and, upon the completion of that duty, in making preparations for taking the field during the coming season; Assistant Gerdes to resume his reconnaissance, triangulation, and topography, in Sections VI, VII, and VIII; Lieut. James Totten to continue his triangulation of the outer reef in Section VI, and Lieut. Joseph S. Totten to execute the triangulation of Georgetown harbor, South Carolina, Section V.

Topography.—Assistant F. H. Gerdes has made a topographical survey of Cedar Keys, embracing sixteen islands proper, besides smaller reefs and shoals, and containing forty-nine square miles of area, with one hundred and fifteen miles of shore-line. In addition, his detailed reconnaissance has furnished the topography

of the harbor of St. Mark's, of St. George's sound, and St. Joseph's bay, Section VII.

The limits of the work are shown in Sketches G, No. 2 and No. 3.

Since his return from the field, Assistant Gerdes has inked the topographical sheets of his works in this section.

Hydrography.—Lieut. Com. John Rodgers, U. S. Navy, assistant in the Coast Survey, continued in charge of the hydrography in Section VI, having command of the Coast Survey steamer Legaré and a schooner. He reports the hydrography of this season as finished, commencing at the northern extremity of the reef, from Narrows cut to Triumph reef. (See Sketch F, No. 1.) The chart includes eighteen miles of latitude and twenty-two of longitude, embracing about 335 square miles of hydrographic work. About 125 miles of soundings were added to the unfinished chart of Boca Grande, and about 100 miles of soundings run, to be added to the chart of Key West. (See Sketch F, No. 3.) Current observations were also taken for the harbor and approaches to Key West. Lieut. Com. Rodgers reports as found, near the Rebecca shoal, another not laid down on any chart, and which he has named *Isaac*. He also mentions the discovery, in latitude 25° 30′ and longitude 80° 30′, of a passage through the reef, giving access to a harbor which, if properly buoyed, would be valuable as a harbor of refuge to ships passing through the Florida straits.

The work of sounding inside the keys, on the Key Biscayne chart, was confided to Lieut. J. D. Read, U. S. Navy, in the schooner Angle, aided by Passed Midshipman G. Cilley. The inshore work in the same vicinity was executed by Acting Master Julian Myers, aided by Passed Midshipman Hunter Davidson, U. S. Navy.

After returning from the field, the party of Lieut. Com. Rodgers finished the reduction, and plotted the soundings of their last season's work. During the next season the party will be under the command of Lieut. Com. T. A. Craven, U. S. Navy, assistant in the Coast Survey, in consequence of the detachment of Lieut. Com. Rodgers, ordered to the expedition fitting out for the Behring Straits and Pacific exploration.

A hydrographic reconnaissance of the harbor of St. Mark's, St. George's sound, and St. Joseph's bay, and of Channel No. 4, Cedar Keys, has been furnished by Assistant F. H. Gerdes, from his surveys of those localities.

SECTION VIII.—FROM MOBILE POINT TO VERMILLION BAY, INCLUDING THE COAST OF ALABAMA, MISSISSIPPI, AND PART OF LOUISIANA. (Sketch H.)

In this section the parties for hydrography, secondary triangulation, and topography, (supplied, respectively, with a steamer and sailing-vessels,) were organized as in the previous year, and have furnished results of increased extent and interest. A reconnaissance of the features of the coast, islands, and main, has been added, with a view to determine the preliminary data for continuing the primary triangulation—a problem, in this case, of more than usual difficulty. The secondary triangulation of the coast of Louisiana, and the topography closely following, have made good progress. To the general prosecution of the work have been added special surveys of the Chandeleur islands and adjacent sounds,

of Naso roads, and of Milneburg harbor; as also a hydrographic reconnaissance of the passes leading into the Gulf from the Mississippi river. The report of the latter examination (Appendix No. 16) has brought to light the changes occurring since the survey of 1839, and the probability of increased facilities to commerce offered by the Pass à l'Outre, and presents judicious comments upon the peculiar advantages of that pass, with suggestions as to the mode of its improvement.

Since the close of the season in this section, a hurricane has swept over that portion of it from Chandeleur bay to Mobile bay, and has so altered the regimen of the vicinity of some of the islands as to induce a re-examination of Naso roads, and of Horn Island pass, before publishing the charts which had been prepared. The light-house at the Chandeleur islands was destroyed. A break was made through Ship island, and also through Petit Bois island. The results of the re-examinations will be given in my next report.

Charts and sketches of Mobile bay, Pass Christian, Cat Island tide diagrams, entrance to Mobile bay, and Mobile bay Nos. 1 and 2, have been published.*

Reconnaissance for primary triangulation, &c.—The general examination of the northern coast of the Gulf of Mexico, its harbors, adjacent islands, and channels, by Assistant F. H. Gerdes, has already been noticed in the account given of the two sections preceding. For its results, as regards this section, see again the memoir (Appendix No. 12) and the general Sketch H. Sketches were made representing on a larger scale the portions examined most in detail, comprising the Chandeleur and Isle au Breton sounds, with the neighboring islands and main, and indicating the scheme for a primary triangulation. That this work must involve more than ordinary difficulties, and require an unusual amount of artificial aids, will appear evident from the distances necessary to be overcome, and the absence of natural elevations alike on islands and main land. The preliminary survey of Naso roads, Chandeleur island, (Sketch H, No. 1,) was executed in part by Mr. Gerdes, in conjunction with the hydrographic party under Lieut. Com. Sands.

Secondary triangulation.—Assistant S. A. Gilbert had charge of the party engaged in this branch of the work. The season proved more than usually favorable, and the amount of work accomplished exceeds that of the previous year. The secondary triangulation was continued from Cat island westward, over Lake Borgne, and embracing the eastern portion of Lake Pontchartrain. (See Sketch H, No. 1.)

Mr. Gilbert also made a hydrographic reconnaissance of Milneburg harbor, the lake terminus of the New Orleans and Pontchartrain railroad. His report, in part, is annexed, (see Appendix No. 15, and Sketch H, No. 1,) for the benefit of those interested, at whose request the examination was undertaken. Mr. Charles M. Bache was attached to the party as aid.

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* The continuation of the results of discussion of the tidal observations given in my last report will be found in the Appendix to the present, No. 22. This formed the subject of a memoir presented by authority of the Treasury to the American Association for the Advancement of Science, at its meeting held in Albany in 1851.

The statistics of the results of the season, from January 3 to June 22, are as follows:

Area covered by the triangulation - - - - -	512 square miles.
Number of stations determined - - - - - -	25
Number of stations occupied - - - - - -	11
Number of angles observed - - - - - -	57

The instrument used in the observations was the ten-inch Gambey theodolite, (C. S. No. 23.)

Mr. Gilbert, after returning from the field, was engaged in the computations of his triangulation of the past season, and in making arrangements for resuming operations in this section.

Topography.—Assistant W. E. Greenwell has completed the topography of Mississippi sound, the coast of the State of Mississippi, and the group (forming about one-fourth of the shores of Lake Borgne) known as the Malheureux islands. (See Sketch H, No. 1.)

In his report, Mr. Greenwell dwells upon the importance of the timber region to which Mississippi sound forms an outlet, and its, as yet, imperfectly known facilities of access:

"The timber is inexhaustible, and the facility of getting it to the mills very great. The sound, too, forms a secure anchorage for vessels of any size, whilst the different passes from the Gulf into it are so plain and accessible as to offer, when once known, no obstacles. Few are yet aware of the depth of water that can be carried through these passes. When charts of this part of the coast are published they will, no doubt, more fully develop the resources of this region."

"In addition to this lumber trade a new source of wealth has sprung up in the export of spars, which can in no part of our country, probably, be found so easy of access to the water, more free from defects, or of larger dimensions."

Mr. Greenwell also visited and secured the western terminus of the measured base on Dauphine island.

Mr. William M. Johnson was the aid of Mr. Greenwell. During the season, January 4th to June 5th, the area surveyed was sixty-nine square miles; extent of shore-line, two hundred and fourteen miles; of roads, forty-seven; of streets and wharves, sixteen. Three sheets have been furnished, on the scale of $\frac{1}{20,000}$.

After inking his sheets, Assistant Greenwell was attached to the party of Assistant Edmund Blunt, engaged in the triangulation of the Hudson river, New York, until October, when he commenced making his arrangements for taking the field for the continuation of the topography of last year in this section.

Hydrography.—Lieut. Com. B. F. Sands, U. S. Navy, assistant in the Coast Survey, resumed from last year, in the Coast Survey steamer Walker, the hydrography of this section. The reported results comprise the soundings of Mississippi sound from Dauphine island to the meridian of Round island, including the entrance at Horn island passage; outside soundings (ten miles to sea) from the middle of Petit Bois island to the middle of Horn island, sixteen miles; a reconnaissance of the South and Southwest Passes of the Mississippi Delta; and a

survey of Naso roads, at the north end of Chandeleur island. (See Sketches H, No. 3 and No. 4.)

"Horn island passage is closely sounded out, showing a straight channel of sixteen feet, which, with common spar-buoys upon the shoal spots, four in number, could be made safe and easy of access." (See Appendix No. 16.)

"The survey of Naso roads shows a good harbor of refuge for any class of vessels, from all winds from S.W. around by south to N.E., and particularly desirable to vessels falling to leeward on the coasts of Alabama and Mississippi in easterly gales."

The report made by Lieut. Com. Sands upon the mouths of the Mississippi involves matters of such importance and general interest, that I quote from him at length, as follows:

"The reconnaissances made by me in June, 1851, and May, 1852, by your direction, show that material changes have been made in all the passes since the survey by the Topographical Bureau in 1839.

"The Pass à l'Outre has deepened, while the Southwest, and indeed all the outer passes, have shoaled. The Southwest Pass has extended nearly a mile further into the sea, in a southwesterly direction; the Pass à l'Outre nearly three-fourths of a mile in an easterly direction; the deposite having been pushed out further by the current in the direction of the passes, and gained thus much in the struggle between it and the waves of the Gulf, caused by gales from the southward of east or west—tending to prove that in the aggregate the current of the Mississippi has the preponderance over the force of the waves, which leads me to believe that a good channel may be kept open by 'dragging' or raking, as suggested by Professor Forshey, of New Orleans, which will keep alive the mud, and allow it to be carried off by the current.

"I believe the Pass à l'Outre to be the one most easily kept open, and the best for commerce; most easily, because, although less water is now found upon that bar than on that of the Southwest Pass, yet we have evidence of its gradually deepening, and it is of a softer nature and more readily moved. The bar being nearer the mouth of the pass, and the current confined to a smaller space by the narrower pass, a channel could be better preserved, with the aid of dragging or raking, than at the Southwest Pass, where the pass is wider, the bar further removed from its mouth, and spreading over a wider surface; best for commerce, because the most convenient of approach and departure for the large class cotton ships bound to and coming from the eastward. The dangerous point of South Pass is avoided; towage up more frequently dispensed with, as the prevailing winds are favorable for sailing up the pass; and in going to sea with head winds, the current gives them an offing on their course. While the Southwest Pass is the most convenient for the small class of vessels bound to and from Texas and Mexico, it is the most difficult of approach and departure from and to the eastward, on account of the dangerous point of South Pass, out of which the current is not of that strength to set a vessel off from it, and where there is generally an eddy current, which makes it dangerous to approach by night or in bad weather, and vessels bound eastward with head winds are drifted to the southward and

westward by the current, far off their course, in getting an offing, and are deprived of the favorable current out of the Pass á l'Outre.

"The channel should have at least eighteen feet water in it; more would, of course, be better, but few merchant vessels draw more water than that. The breadth should be one hundred and fifty feet, to afford ample room for vessels to pass each other, and to allow a vessel to swing round to the current in case of grounding on either side of the channel; otherwise the channel might be often blocked up by vessels getting across it, by a little carelessness of the helmsman, in such a current as sweeps through those passes."

The season's work commenced early in March, and terminated the first of June. The hydrography would have been entered on earlier, had not the steamer been ice-bound in the Delaware. Its statistics are as follows:

	Area in square miles.	Miles of soundings.	No. of soundings.	Angles measured.
Mississippi sound and coast of Mississippi	311	1,268	59,084	2,077
Naso roads	16	81	3,500	160
Mississippi Delta	8	137	2,778	57
Total	335	1,486	65,362	2,294

All the reductions and plotting of the last season's work of this party have been made in the office since their return from the section, and all the preparations made for taking the field for the ensuing season.

SECTION IX.—FROM VERMILLION BAY TO THE BOUNDARY, INCLUDING PART OF THE COAST OF LOUISIANA AND THAT OF TEXAS. (Sketch I.)

The survey of this section has continued on the same scale of organization (three parties, with two vessels to the hydrographic party) as the previous year—the land part of the survey having been prolonged as far as the appropriation, and the water part as long as the season permitted. The season was again unfavorable for work, and the prairies were flooded to an extent which drove the triangulation party from their station.

The secondary triangulation, reconnaissance, and erection of signals, have been extended to embrace the eastern portion of Matagorda bay. The topography has followed, in completion, so far westward as to cross the Brazos river. The hydrographic work, observations of tides, &c., has been continued in and about Galveston bay, and has furnished a complete sketch of Half Moon shoal. The officer in charge of the hydrography reports that the tides show a mean on this coast of a half foot less than last year. These variations are not of rare occurrence, and accordingly the previous soundings on the bar will be reduced to the tides of this year, that the chart may be rendered more safe by giving the *least depth.* The Galveston bar is reported to be gradually working to the southward. A second edition of the Galveston Bay chart has been published, and a harbor chart of Galveston entrance; also a sketch of Half Moon shoal.

The tides at Galveston are of the same class as at Fort Morgan and Cat island, but their inequalities are much greater than at these stations, and will require continued observations to eliminate. The discussion of them, by Mr. W. W. Gordon, has been going on under my immediate direction, as the results have come in.

Triangulation, &c.—Assistant James S. Williams (aided by Sub-Assistant Spencer C. McCorkle, and during part of the season by Mr. Edward Goodfellow) has continued this work, postponing for the present, to the secondary measurements and to reconnaissance, the further prosecution of the primary triangulation. From the line Cotton-Wood—Peninsula, of the sketch, the secondary triangulation has extended along the coast westward as far as Cedar lake. (See Sketch I, No. 1.) The interior stations west of the Brazos could not be occupied on account of the flooded state of the country. The reconnaissance has gone so far as to include the eastern portion of Matagorda bay. The work of this party, commencing with the new year, was brought to a close in the latter part of April, by the exhaustion of the appropriation available.

The points in this secondary triangulation have been located with a view to saving expense in cutting the timber, which follows the course of the streams, in narrow but very heavy belts, to within about two miles of the Gulf coast.

The amount of the season's work may be summed up as follows:

Number of stations occupied—one primary, ten secondary	11
Number of angles measured	37
Number of observations	1,397
Number of signals erected	13
Area of triangles, according to number of angles measured	196 square miles.

The instrument used in these observations was the six-inch Gambey theodolite, No. 12.

After his return from the field, Assistant Williams was engaged in the computations of his work of the last season, and in making preparations for resuming the triangulation during the next season.

Sub-Assistant McCorkle was engaged in the drawing department of the office until the time for making preparations to resume the field with Assistant Williams.

Topography.—Sub-Assistant J. M. Wampler and party, with the Coast Survey schooner Nymph, were employed in this section during the first four months of the current year, when the limit of triangulation which was available was reached. Mr. G. W. Parish served as aid of Mr. Wampler.

The topography resumed from last season at West Island base has been extended westward across the Brazos river, and is complete as far as Jupiter station. (See Sketch I, No. 1.) The amount of work is thus stated:

Number of miles of shore-line surveyed	163½
Area, in square miles, of country surveyed	62½

After inking his sheets, Sub-Assistant Wampler was detached to assist in the prosecution of the survey of proposed routes for the introduction of water into the city of Washington, under the charge of the Engineer Bureau of the War

Department. Having finished his duties in that connexion, he is now engaged in the drawing department of the office.

Hydrography.—Lieut. Com. T. A. Craven, U. S. Navy, assistant in the Coast Survey, commanded the hydrographic party in the Coast Survey schooner Morris. The unfavorable season, from February 14 to May 21, afforded but thirty-five working days, and has not permitted an entire chart of the upper (Galveston) bay to be completed. The limits of the season's work are indicated on the sketch as follows: by a line from Parr's Grove to Smith's Point, on the north side; Red Fish bar on the northwest; a line from Virginia Point to Eagle Point on the southwest; and outside off the bar to a depth of four fathoms. (See Sketch I, No. 2.) In addition, a sketch of Half Moon shoal has been furnished, founded on a more thorough examination. Upon this shoal Lieut. Com. Craven remarks:

"A small portion of the ridge is bare at low tide this year, and I find it to consist entirely of shells, broken very fine. This was last year taken by me for quicksand, which is very firm and hard below the water. There were two feet water on the shoal when I examined it last year.

"I have sounded about the shoal with an iron-pointed rod, and found it hard and firm inside of six feet. On the northerly side the water deepens regularly, but very rapidly; on the southerly side it is 'steep to' at first, but deepens regularly outside of five feet. A section of the shore from north to south would give a profile, * * * * terminating in a sharp ridge. Outside of seven feet the bottom is soft mud."

The following is an exhibit of the season's work:

Area surveyed, square miles	132
Miles of sounding lines run	839
Number of soundings taken	53,414
Number of angles observed	2,198
Greatest depth of water, fathoms	8
Least depth of water, feet	1
Number of stations for tidal observations	4

Two stations were also occupied for current observations, which were materially interrupted at night, during a portion of the time, by high winds.

After the completion of the reduction and plotting of his work in this section, Lieut. Com. Craven, in command of the steamer Corwin, made the survey of Cape Roman shoals, South Carolina, placed the Hatteras bell-boat, and performed other duty in Sections IV and V, noticed under appropriate heads.

SECTIONS X AND XI.—FROM SAN DIEGO TO LATITUDE 49°, INCLUDING THE COAST OF CALIFORNIA AND OREGON. (SKETCH J.)

Six parties have been employed in these two sections during the year, and have transferred their operations from one portion of the coast to the other, as their co-operation and the changes of the seasons demanded.

The progress in the section has been in general very good, and all the parties have made great exertions in their several spheres of work.

One of these parties has been engaged in making astronomical and magnetic observations, two in the execution of triangulation, two in topography, and one in hydrography, a double party—employing a steamer and sailing-vessel. The geographical positions of Presidio, (San Francisco bay,) California, of Scarboro' harbor, (or Neeah bay,) Oregon, and of Port Orford, Ewing harbor, Oregon, have been determined. Observations for the magnetic variation have been made at the same points. Preliminary geographical determinations have been made of several points of the coast and Santa Barbara islands, in connexion with the hydrographic reconnaissance of that vicinity.

The determinations of Cape Mendocino and Cape Foulweather would complete the scheme of preliminary geographical positions for nearly every two degrees of latitude from the southern limit of California to the northern limit of Oregon.

The triangulation of San Francisco bay, its approaches, and dependencies, has been nearly completed; that of Monterey harbor extended to connect with the astronomical station and the light-house survey of Point Pinos. A base was measured at the mouth of the Columbia river, and the triangulation of the river carried up a distance of about thirty-five miles. The topography of the bay of San Francisco has been continued, and that of the towns and bays of Monterey and San Diego, California, and of False bay, near San Diego, executed. Topographical sketches for light-house and other purposes have been made of Port Orford, Cape Hancock, Point Adams, and Cape Flattery, Oregon. A hydrographic reconnaissance of the coast south from Monterey to San Diego, including the Santa Barbara islands and channel, California, of the coast of Oregon, north from the Columbia river to the boundary, and of the entrance to Shoal Water bay, has been made. The hydrography of San Francisco bay is in progress, and that of San Diego, Monterey, and Humboldt harbors, California, has been executed.

A very important series of tidal observations was made by my instructions in San Francisco bay, by Lieut. Comg. Alden, consisting of one series for a lunation at Sancelito, and another for the same period at Rincon Point. They have been reduced, under my immediate direction, by Mr. W. W. Gordon, and have yielded the most interesting results. The tides at San Francisco consist of one large and one small tide each lunar day, the diurnal inequality being very large both in height and time. I propose, as early as practicable, to publish the results of the discussion of these tides, and to give rules founded upon it. Special provision will be made for extending tidal observations along this coast without interfering with the regular progress of the hydrography.

The following charts have been received and published during the year, or are nearly ready for publication: Catalina harbor; Monterey harbor; San Francisco city; Prisoners' and Cuyler's harbors, and northwest anchorage of San Clemente; San Pedro; Santa Cruz; San Simeon; San Luis Obispo; Point Conception and Coxo; Alden's reconnaissance from San Diego to Sir Francis Drake's bay; Mare Island straits; entrance to San Diego; Humboldt bay; McArthur's reconnaissance, third edition; San Francisco bay and Santa Barbara, California; and mouth of Columbia river, and Cape Hancock, Oregon.

By authority of the Treasury Department, tracings of the work of the Coast Survey in the vicinity of San Francisco were communicated to the board of commissioners for the location of a naval depot. The correspondence of the secretary of the board with Assistant R. D. Cutts may be found in Appendix No. 25. Information of the same character has been furnished to the army board of engineers engaged in planning the defensive structures in the harbor of San Francisco. The service rendered by the information thus furnished is noticed in a complimentary manner by Gen. Joseph G. Totten, in his report to the Secretary of War, an extract from which is given in Appendix No. 24.

Astronomical and magnetic observations.—The geographical position of Presidio, (San Francisco) of Port Orford, Ewing harbor, near Cape Orford, Oregon, of Scarboro' harbor or Neeah bay, near Cape Flattery, entrance to Puget's sound, Oregon, have been determined by Assistant George Davidson and his aid, Mr. John Rockwell. Mr. Davidson also made preliminary determinations of latitude and difference of longitude of the following points on the southern coast of California, viz: Santa Cruz, San Simeon, San Luis Obispo, Santa Barbara, Prisoners' harbor, San Pedro, Santa Catalina, San Clemente, San Nicolas, and Cuyler's harbor.

These preliminary results were in connexion with the hydrographic reconnaissance of Lieut. Comg. Alden, which will be again referred to. The positions are reported in Appendix No. 17. Mr. Davidson also determined the latitudes and differences of longitude from Neeah station, of False Dungeness and Point Hudson, Oregon.

The work of the past year, including observations for longitude, latitude, and magnetic and meteorological observations, is given in the following table:

For longitude, including observations upon I and II moon's limb, and culminating stars in connexion with them	3,760
For latitude upon 729 pairs and triplets, and 504 stars	2,745
On magnetic term days—declination—zero—azimuth—horizontal intensity, &c.	2,616
Meteorological	12,112

Most of these observations have been reduced, and their results furnished to the hydrographic party, and sent to the office.

At the time of my last report Assistant Davidson's party was at Cape Disappointment. After completing the work there, they next occupied a station at Ewing harbor, near Cape Orford, not without the probability of interruption from the Indians; thence proceeded in the southern reconnaissance, receiving transportation in the Coast Survey steamer Active; next to Columbia river and to Cape Flattery. At Cape Flattery it was necessary to intrench themselves and to keep a regular watch against the natives, who became very annoying during the progress of the observations there. Assistant Davidson endeavored to land at Cape Mendocino, on his way down the coast, but the stormy character of the season prevented it. He is now under instructions to take up the survey of the islands near the Santa Barbara channel.

Observations of magnetic variation were made by Assistant Davidson at Port Orford, Oregon, San Francisco, and Neeah bay, Oregon.

The extract from Assistant Davidson's report, given below, will exhibit the dangerous situation of the party during the occupation of Neeah station, (Scarboro' harbor) in Oregon Territory: "I consider the station to have been occupied at very great risk, from the hostility of the Indians, but a knowledge that we were always prepared for any attack, without doubt, prevented one. We built a breastwork, and could fire sixty loads without reloading. Guard was kept eight hours every night."

Triangulation.—Assistant R. D. Cutts has continued, as heretofore, in charge of the double party in execution of triangulation and topography on this coast. During the whole year one triangulation and one topographical party have been in active operation, and by employment of additional aid, as time and circumstances rendered advantageous to the work, the number of parties has been increased to four.

The triangulation of San Francisco bay (see Sketch J, No. 2) is nearly completed, and extends from Red Hill, near San Jose, to San Francisco; thence northwardly to the bay of Suisun, and along the coast from Table mountain to the vicinity of Mount Clara. The coast series of triangulation was executed by Sub-Assistant Joseph S. Ruth.

The Presidio is the astronomical point upon which this work at present depends, and the azimuths are given by one hundred and eighty-eight observations taken at Point Avisadera.

The triangulation of the town and extreme limits of the harbor of Monterey (see Sketch J, No. 3) has been made and connected with the astronomical station and light-house survey of Point Pinos, and observations for azimuth have been made here by Sub-Assistant Ruth.

The season of the year being favorable for work in Oregon about the end of May, Assistant Cutts proceeded to the mouth of the Columbia river, Oregon Territory, (see Sketch J, No. 10) and, with the assistance of Sub-Assistant Ruth, commenced the triangulation of the river from Bunce's to Cathlamet Point, to its mouth, a distance of about thirty-five miles, embracing the difficult portion of the navigation of this river. This triangulation rests upon a base of about two miles in length, lying on Baker's bay.

The statistics of the operations of the portion of the party executing triangulation are thus given:

Preliminary base measured	1
Signals erected	90
Stations occupied	64
Angles observed and determined	362
Number of direct measurements	9,650
Stations whose altitudes were trigonometrically determined	31
Vertical angles measured	505
Observations for azimuth	306

This triangulation was nearly brought to completion, when it was interrupted by the sudden and distressing death of Sub-Assistant Joseph S. Ruth, who was

drowned by the capsizing of a boat near Astoria, on the seventeenth of October last. He had been connected with the Survey for nearly eight years, and had risen from a subordinate position to one of confidence. His qualities of mind and early training particularly adapted him to success in such a work, and his early career gave a promise of great usefulness in positions of high responsibility. His loss is much deplored by his associates, who were his warm friends, and has been particularly felt by me, from a connexion beginning in his school-boy days, at the Philadelphia High School, and strengthening as his mind and character developed, year by year. The resolutions adopted by the officers of the western coast, expressing their sense of Mr. Ruth's merits, with my letter to his family, are given in the Appendix No. 32.

Assistant Cutts made observations for azimuth at Tongue Point Neck. The astronomical station at Cape Disappointment is connected with the triangulation of the Columbia river.

The computations of the work of this party are made and duplicated as they advance, and then turned into the office.

The special appropriation for the survey of the islands off the Santa Barbara channel, and south of it, was made only in August, and instructions were at once issued to a portion of the parties to take up this work, if the season would permit, on returning from Oregon for the winter. The death of Mr. Ruth has interfered with the exact execution of these instructions, but provisional arrangements have been made to meet the emergency.

Topography.—Three parties have been engaged in the execution of the topography of these sections:

1. Sub-Assistant A. F. Rodgers, under the direction of Assistant R. D. Cutts;
2. Sub-Assistant A. M. Harrison, in charge of a party; and,
3. The topographical sketches of points determined by Assistant George Davidson, which have been made by Mr. James S. Lawson.

The party under the charge of Assistant Cutts has been diligently employed in the topography of San Francisco bay and harbor, (see Sketches J, No. 2 and No. 6,) with a view to the early completion of the harbor chart. The peculiar, bold, and rugged character of the topography of the vicinity, required the operation of two plane-tables to bring the work to completion by the time desired. The party of Sub-Assistant Harrison has been transferred to assist the party of Mr. Cutts in accomplishing the object desired. This immediate vicinity is represented to be subjected to very high winds and dense fogs, which are unfavorable for the execution of plane-table work.

The work done by this party is thus given:

Sheet No. 3. Town and harbor of Monterey.
No. 4. City of San Francisco and vicinity.
No. 4½. Island of Yerba Buena.
No. 5. Contra Costa.
No. 6. Contra Costa.
No. 8. Angel island, &c.
No. 9. Coast north, nearly completed.

Sheet No. 10. Coast south, nearly completed.
Tracing of all the work above executed.
" " " for commission for locating naval depot.
" " " for hydrographical party.

Since the date of my last report, Sub-Assistant A. M. Harrison has executed the topography of Sand island and Ewing harbor, Oregon, sheets Nos. 2 and 3; of San Diego, False bay, Santa Barbara, and San Francisco, sheets Nos. 10 and 11. (See Sketches J, No. 1 and No. 6.)

The statistics of the work are thus given by Sub-Assistant Harrison:

Sheet.	Miles of shore-line.	Lakes and streams.	Square miles.
Sand island	1.00	.....	0.05
Ewing harbor	7.90	.....	1.20
Ewing harbor	3.25	4.50	3.80
San Diego, No. 2	24.00	11.37	9.00
San Diego, No. 3	17.75	22.33	9.50
False bay	21.50	21.33	14.75
Santa Barbara	3.50	5.12	7.25
San Francisco, No. 10	6.00	8.75	13.25
San Francisco, No. 11	0.50	.....	1.50
Total	85.40	73.40	60.30

These sheets of this party have been nearly all inked and turned into the office.

The topography of Cape Flattery (see Sketch J, No. 1) has been executed by Mr. J. S. Lawson, attached to the party of Assistant George Davidson. The difficulties of plane-table work on this part of the coast are represented to be very great, the work being necessarily carried on in small canoes, the only kind of boat which can land upon the rocks.

The work executed there embraces seventeen and a half miles of shore-line, and covers an area of thirteen square miles.

Hydrography.—The preliminary reconnaissance of the western coast from Columbia river to Monterey was executed by the lamented Lieut. W. P. McArthur. The first endeavor of Lieut. Comg. James Alden, his successor, was to complete the reconnaissance from Monterey southward to San Diego. Waiting for the arrival of the steamer Jefferson, Lieut. Comg. Alden, in the Coast Survey schooner Ewing, made a preliminary survey of Trinidad bay and of Humboldt harbor, and completed the survey of Monterey bay, of which sketches have been published.

The loss of the Jefferson having been ascertained, a steamer was at once hired by Lieut. Comg. Alden for the southern reconnaissance, which was carried from San Francisco to San Diego, and the chart of which accompanies this report. Opportunity having occurred to make the purchase, upon favorable terms, of a suitable steamer for our work on the western coast, thereby avoiding all the delay and risk attending the sending one of those small steamers from the Atlantic side, Lieut. Comg. Alden was enabled, in January last, to make further examinations of

the coast south between San Francisco and San Diego, including the islands between Point Conception and Point Loma. Combining his operations with preliminary astronomical determinations by Assistant Davidson, a very useful reconnaissance has been made. Charts of the following harbors and anchorages have been produced, and have been engraved in the office to accompany this report: Catalina; San Pedro; San Clemente; Prisoners' harbor; Cuyler's harbor; Santa Cruz; San Simeon; Coxo, and San Luis Obispo. (See Sketches J, No. 4, No. 5, No. 7, and No. 8.)

Passing up the coast in September last, Lieut. Comg. Alden, in the steamer Active, completed the reconnaissance from Columbia river entrance to the northern boundary of Oregon, including an examination of Shoal Water bay and of Neeah harbor. His report on Shoal Water bay will be found in Appendix No. 19.

It was Lieut. Comg. Alden's intention, in compliance with instructions, on returning from the north in October, to make a survey of the Umpqua river entrance, especially in reference to the position of a light-house, for which an appropriation by Congress had been made, and to revise the reconnaissance between Columbia river and San Francisco, and to land the party of Assistant Davidson at Cape Mendocino. The whole of this plan was frustrated by the unusually boisterous character of the season. In a letter dated San Francisco, October 15, 1852, Lieut. Comg. Alden says: "Much to my chagrin, and contrary to all expectations, I find myself once more, and at least two weeks sooner than I intended, at this place. It has happened in this wise: leaving the Columbia river on the 6th, where I wrote you last, I proceeded to the entrance of the Umpqua river. On our arrival there the fog, for one day, prevented our seeing or hearing anything but the surf; when that cleared up, I found the bar breaking so heavily that it was not practicable either to enter with the steamer or examine it with the boats, and, after spending another day in fruitless attempts to get in, I reluctantly bore up for Port Orford. It appears from the beacons which have been put up, and which are still standing, for the range for entering the Umpqua, that that opening has changed to the southward, at least its whole width. I enclose herewith the tracing of Mr. Scholfield, which contains the beacons and range for going in: they were distinctly visible from the steamer's deck, and as clearly impracticable. I have put upon the tracing in *red*, as nearly as I could judge, the position of the entrance as it appeared, which will show very plainly that there has been a very important change since Mr. Scholfield's survey was made. In regard to this matter, I know well how anxious the residents in that vicinity are to have their river examined; but I am confident that none could be more so than I was, and I went there determined to do it at almost any risk; but after trying to get in for two days, with my fuel getting short, and no prospect of better weather, I was compelled to bear up. It was then blowing so fresh, with such a heavy sea on during the night, that I at daylight found myself to leeward of Port Orford; and although I had the mails on board for that place, I was compelled to give that up also. We then stood for Trinidad bay, where I knew there was some shelter, at least, and where I intended to hold on till the weather should be such that we could get

into Humboldt bay. My object in visiting this last-named place was, as I have informed you, first to see if there had been any changes at the entrance; and, secondly, to see if Mr. Davidson could by any means get from there overland to Cape Mendocino, as I found, and as the result proved, it would be impossible to land him on that rugged cape. After remaining at Trinidad till the weather had somewhat improved, I made an attempt, but was compelled by the fog to return to the anchorage; after a delay of some hours more I tried it again, and found, when we got there, the sea breaking entirely across, and at the same time could distinctly see that the ranges for going in, which are laid down on our survey of last year, were entirely useless, for the entrance has evidently changed very much—I should think its whole width—to the northward; so, after a delay of twenty-four hours, and burning coal all the time, (the sea being so heavy we could not anchor,) I bore up for Cape Mendocino, but could find no place there where it was at all practicable to land. The coal getting short after all these delays, I was compelled, although very reluctantly, to proceed to this place. It has been foggy almost continually, with strong winds, ever since we left the Columbia, which precluded, of course, the possibility of our making any examination of the coast on our way down."

The services of W. B. McMurtrie, esq., draughtsman to the hydrographic party, are acknowledged warmly by Lieut. Comg. Alden. The beautiful views which accompany the charts are executed by this officer.

The best information which we had in regard to San Francisco entrance, and the wants of commerce in that quarter, induced the recommendation of a seacoast light at Fort Point. Subsequent examination, and the changes in the character of the commerce now carried on so extensively in steamers, made it doubtful whether Bonita Point were not a more proper position for such a light. Lieut. Comg. Alden having called my attention to this subject, minute inquiries were directed to be made, which have resulted in the recommendation of Bonita Point for placing a seacoast light, and of Fort Point for a harbor light. The report of Lieut. Comg. Alden, with letters from the navigators consulted by him, and other documents relating to this subject, are collected in Appendix Nos. 49, 50, 51, and 52.

Lieut. Comg. Alden has had incidental opportunities of usefulness out of the immediate line of his duty, of which he has, with characteristic zeal and promptitude, availed himself. One was in taking the mails and the government officers, including the commission for selecting a site for a navy-yard and dry dock, from the steamer California, when disabled off the coast near San Pedro. This service was handsomely acknowledged by the Pacific Mail Steamship Company's agent, in a letter given in Appendix No. 27, *bis*. Another was an effort to relieve the ship Samoset, stranded near Fort Point, which, however, proved unsuccessful, the vessel being firmly bedded on the rocks.

OFFICE WORK.

The office, under the charge of Brevet Major I. I. Stevens, of the Corps of Engineers, has not only maintained the very efficient condition to which I had occasion to refer in my last report, but has improved in the system and order of every one of its divisions. The development of the plans required by the increased magnitude of the work has gone forward steadily, and the zeal and ability of the assistant in charge have been reflected in the spirit of the officers in charge under him, and in the general diligence of the employees. The office is characterized by a very marked spirit of industry, of working to results, and of progress. Every encouragement, as it should be, is afforded to those who endeavor to advance in their several occupations.

In his annual report Major Stevens thus refers to the labors of the several departments or divisions of the office:

"In the *computing department*, the preparation of the list of geographical positions for the last year's report brought all the data into a compact form, led to a correct system in the distribution of duties, and rendered it comparatively easy to administer the department for the future. There has been great promptness the past year in answering numerous calls for information, and much work has been done that has heretofore devolved on the longitude parties. The computations of the extensive series of observations of Mr. Davidson on the western coast, and those of Mr. Hilgard in Florida, have all been made by the usual force of computers. It affords me unusual gratification to acknowledge the services of Mr. Hilgard, in charge of this department, and to commend the zeal, promptitude, and accuracy of every member of the department.

"In consequence of the numerous calls for information from the engineer officers in charge of the river and harbor improvements, the *drawing department* has had a very large amount of extra labor thrown upon it, and the miscellaneous duties have much exceeded those of former years. For the Commissions on the Savannah river, the Cape Fear river, and the James and Appomattox rivers, entire copies of our surveys were furnished, and we have received the warm acknowledgments of the local engineers for our despatch in making the copies, and the indispensableness of the information furnished by them for preparing the necessary plans of improvement. I am under great obligations to Captain Foster for the interest he has manifested in the duties of this department since he has been in charge, and for the promptitude which has characterized his discharge of duty.

"A reference to the sketches accompanying the annual report of this year will furnish the best evidence of the improvement that has taken place in the engraving department. The system of teaching the art of engraving to youths of promise is succeeding admirably. By combining lessons in drawing, instructions at night-schools, with engraving, the best spirit is excited and the greatest excellence attained. There are now six lads in the office, whose times average from two to nineteen months. Three of these lads do topography very respectably, and are reliable for constant work, and their number will be increased

by a fourth lad, now good in executing jobs which constantly arise in a large engraving establishment. The remaining two are still beginners. The division of labor referred to in my last annual report has been in a great measure accomplished, and will improve during the present year. I present Mr. Tinkham as meriting your most cordial approbation, for the zeal, energy, and excellent administrative qualities which he has shown in managing this department of the office."

The special computations of longitude and of telegraphic work of former years have been under the charge of Assistant L. F. Pourtales, who has reduced the results of the chronometer expedition between Portsmouth, Virginia, and Forbes' Point, North Carolina.

Assistant S. C. Walker left the charge of the party, on account of ill health, in January last, and Assistant Pourtales took charge. Since that time the party has been engaged in the reduction of results of the telegraph campaign between Halifax, Bangor, and Cambridge, a recomputation of the results of the telegraph campaign between Charleston and Savannah, and the reduction of those obtained between Seaton station, in this city, and Roslyn, near Petersburg, Virginia.

Professor O. G. Pendleton, U. S. Navy, assistant in Coast Survey, has computed the longitudes of Georgetown, Philadelphia, and Cambridge, by moon culminations made in 1847, coincident with the European observatories; of Point Pinos, San Diego, and Point Conception, California, and of Cape Disappointment and Ewing harbor, Oregon.

The health of Professor S. C. Walker, assistant in the Coast Survey, impaired by his labors, gave way at the close of the telegraphic operations for connecting Bangor and Halifax, in February last. He was, however, enabled to resume his work of computation in the autumn, and made an elaborate report in September on the longitude of San Diego.

Special computations of the tidal observations have been made, under my immediate direction, by Mr. W. W. Gordon, who has, with the assistance of Messrs. H. Mitchell, J. R. Offley, H. Heaton, and T. S. Homans, been engaged in arranging, tabulating, and discussing the new observations, and in revising those of former years. This division of computation is gradually being moulded into form, and the practical and scientific results are being deduced from the elaborate discussion of the observations as they accumulate. The attempt to carry out these computations by the aid of the officers of the hydrographic parties failed, chiefly from the frequent changes to which they were incident, which prevented a systematic execution of the work.

In my next report I shall be prepared to give more in detail the progress made in this division of the work.

An interesting and valuable extract from the same report, relating to the process of lithographic transfers and the conditions necessary to insure success in this art, will be found in the Appendix No. 21. In the course of it Major Stevens acknowledges, with approval, the services of Lieut. E. B. Hunt, of the Corps of Engineers, who superintended the work of transferring the plates of my last year's report, of which a larger edition than usual was ordered both by the Senate and

House of Representatives in consequence of the publication of the tables and sketches of geographical positions.

The nicety and entire reliability of our ELECTROTYPE PROCESS of reproducing plates has had a severe test in the general chart of the coast, recently published, from Gay Head to the Capes of the Delaware, and in the joining of several plates. The copy of the general chart was exact to the minutest line, and the metal was of very superior character. Mr. Mathiot has been sick many months during the year, and is now somewhat of an invalid. His assistant, John Cronin, during his sickness, made an electrotype plate with entire success, and the department has now reached the point when almost any enlargement to its operations can be made with ease. It is important that the electrotypist should have a good deal of leisure to study improved processes, and provide for the little difficulties incident to the operation. Forecast is constantly required, and with a zealous and faithful assistant like Mr. Cronin, who can inspect the work and perform the severer labor, the condition for bringing out Mr. Mathiot's full force is fulfilled. The accommodations, as to rooms, are very poor and inadequate. A proper building will soon be indispensable.

The details of the work in these and the other divisions of the office, under the heads of—1. Computing; 2. Drawing; 3. Engraving; 4. Electrotyping; 5. Printing; 6. Publishing, distribution, and sale; 7. Instrument making; 8. Archives and library—are given in the following pages.

1. COMPUTING.—This department has continued under the charge of Assistant J. E. Hilgard; Mr. Charles A. Schott acting for him during an absence in the field of five months. During the year the computations of the current field-work have been made without delay; the verification of the work of former years has made reasonable progress, and a further advance has been made in arranging the results, enabling this department to supply promptly whatever data may be required for the use of the office or field parties.

Mr. E. Nulty has reduced the observations for latitude at stations Savannah, Section V; San Diego, Section X; Port Orford, Section XI; Causten's, Section III; Cape Small, Section I; the observations for azimuth at Point Avisadera, San Francisco bay, Section X; and the transits for time and longitude at Savannah, Section V; at Point Pinos, bay of Monterey, and the Presidio of San Francisco, Section X; and at Cape Disappointment, Section XI.

Assistant Theo. W. Werner has computed in Section I the secondary triangulation in New Hampshire and Maine, 1850–'51; in Section II the secondary triangulation of Hudson river, 1851; in Section III, the primary and secondary triangulation in Chesapeake bay and on the seacoast of Virginia, 1851; in Section IV, the secondary triangulation south of Cape Hatteras, 1851, and that of Core sound, 1852; in Section VI, the secondary triangulation of Key Biscayne bay, 1851–'52; in Section VIII, the secondary triangulation in Mississippi sound and Lake Borgne, 1850–'51; in Section IX, the secondary triangulation on the coast of Texas, 1851; in Section X, the secondary triangulation and azimuth observations in the bay of Monterey, and the magnetic declination at six stations on the western

coast. He has also made a check computation of the conditional equations of primary triangulation in Chesapeake bay, south of Kent island.

Mr. C. A. Schott has been engaged in making a complete register of observed magnetic declinations, dips, and intensities, and occasionally in examinations of hydrographical work. He has computed the observations of latitude at Santa Cruz, San Simeon, San Luis Obispo, Santa Barbara, Prisoners' harbor, and San Pedro, in Section X; has made the reduction by least squares of the angles of the primary triangulation of 1851 in Chesapeake bay, Section III, and has established the conditional equations of the primary triangulation in Section I to 1850. He was during one month engaged in making longitude computations, and during five months has had charge of the computing department, Mr. Hilgard being engaged in field-work. Mr. Schott has also prepared various reports on subjects connected with the survey, among which are—a paper on barometric measurements of heights; one on the lines of equal magnetic declination on the western coast; a plan for the survey of the Santa Barbara islands; a paper on the secular change of magnetic declination on the Atlantic coast, and an outline of nautical surveying.

Dr. G. Rumpff has been engaged in preparing the list of geographical positions accompanying last year's annual report, in keeping up the registers of the computing department, and in making many miscellaneous computations for the use of the office. He has revised the computations of triangulation in Section I, from Point Judith to Boston bay; has made computations of elevations in Sections I, II, and III; of the primary triangulation in Section I to 1851; of the triangulation of Portsmouth harbor, by Capt. Stansbury, Topographical Engineers; of a part of the triangulation in San Francisco bay; of the latitude of Depot Key, Section VI; and of transits and chronometric differences of longitude between Charleston, Key West, Depot Key, and St. Mark's.

Mr. J. Main has reduced the observations for latitude at Cape Disappointment, Section XI; Presidio of San Francisco, San Nicolas, San Clemente, Santa Catalina, Section X; St. Mark's, Section VI; the observations for time and chronometric differences of longitude between San Francisco, Monterey, Point Conception, San Diego, Santa Cruz, San Simeon, San Luis Obispo, Santa Barbara, Prisoners' harbor, San Pedro, Cuyler's harbor, San Nicolas, San Clemente, and Santa Catalina, Section X. He has also revised the computations of latitude of Mount Independence and Savannah, and the reduction of horizontal angles of the primary triangulation in Section I.

Messrs. Ober, Keber, and Gritzner were employed in making check computations of the horizontal angles of the primary triangulation in Section I. Mr. Ober also computed many places of stars for determinations of latitude, and Mr. Gritzner made some reductions of chronometer comparisons for difference of longitude.

Mr. Ober's health, which was at no time firm, gave way entirely in September last, and he was carried off finally by bilious fever, October 7, 1852.

Mr. E. F. Mason reported on the 10th of August, and has been engaged in making L. M. Z. computations of the triangulation in San Francisco bay, and Mr. Chas. T. Jardella, who reported on September 1, has recomputed the horizontal angles of the same triangulation.

2. DRAWING.—The supervision of this department was exercised by Lieut. R. H. Rush, U. S. Army, until March, 1852, when, in accordance with his wish for the more active duties of the field, he was relieved of the charge, and the department was placed under the supervision of Capt. J. G. Foster, U. S. Engineers.

Capt. Foster continued in the discharge of this duty until August last, when, from ill health, he was compelled to leave the city temporarily. He has, within a few days, resumed his position as chief of the department.

Assistant W. M. C. Fairfax has, during the past year, continued the reduction of the topography of No. 3 Eastern series, scale $\frac{1}{80,000}$, and has made a complete reduction of the topography of Lieut. Alden's reconnaissance of the western coast, scale $\frac{1}{1,200,000}$, and of Wellfleet harbor, scale $\frac{1}{80,000}$; the remainder of his time has been occupied in minor reductions, verifications, the study of topographic specimens, and in miscellaneous duties.

Assistant M. J. McClery has continued the reduction of the topography of Chesapeake bay No. 2, and commenced that of Chesapeake bay No. 3, both on a scale of $\frac{1}{80,000}$; he has also, during the year, made a reduction of the topography of Portsmouth harbor, from the survey of the Topographical Bureau, and has spent much time in verification, &c.

Mr. Jos. Welch has been employed almost wholly during the year in reducing the topography of the middle sheet of the Eastern series No. 2, scale $\frac{1}{80,000}$.

Mr. J. J. Ricketts has completed the reduction of the hydrography of the lower sheet of Mobile bay, $\frac{1}{80,000}$, and of Charleston harbor, $\frac{1}{40,000}$; has made the entire reduction of a sketch of New river and bar, and has been engaged on the hydrography of Mobile bay, scale $\frac{1}{200,000}$; general coast chart, scale $\frac{1}{400,000}$; mouth of Connecticut, scale $\frac{1}{200,000}$; Wellfleet harbor, scale $\frac{1}{50,000}$; Nantucket shoals, scale $\frac{1}{200,000}$; Long Island sound, scale $\frac{1}{80,000}$, &c. He has also executed a large proportion of the hydrography of Chesapeake bay No. 2, scale $\frac{1}{80,000}$, and has commenced that of No. 3, on the same scale.

Mr. Wm. Luce was employed from November, 1851, to June, 1852, in reducing the western sheet of Albemarle sound, scale $\frac{1}{80,000}$; in making a drawing of the self-registering tide-gauge; in drawing specimens of buoy letters, and in miscellaneous duties. Since June he has been employed in making projections for field-parties on contract.

Mr. A. Boschke having been engaged on field-duty from November to December, 1851, returned at that time to the office, and until June rendered very valuable service in preparing projects for charts and sketches, verifying, and preparing various sketches for the annual report, making projections on copper and for reductions, and in miscellaneous duties. In June last he was relieved from duty, in the hope that a short service in the field would serve to recruit his health. It did not, however, have the desired effect, and on his return, leave of absence was granted him until his health shall be restored.

Mr. J. P. R. Mechlin, from November, 1851, to May, 1852, at which time he resigned his situation on the Survey, was employed in reducing the hydrography of Cape Fear river, scale $\frac{1}{40,000}$; North Edisto river, scale $\frac{1}{20,000}$; south side of Long

Island, No. 3, $\frac{1}{80,000}$; Muskeget channel, $\frac{1}{80,000}$; the topography of Ewing harbor; and in miscellaneous duties on sketches for the annual report, &c.

Mr. William S. Walker, sub-assistant in Coast Survey, while connected temporarily with the drawing department from November to February, was occupied in reducing the topography of North Edisto river, scale $\frac{1}{80,000}$.

Mr. M. C. Gritzner, from February to May, when he was transferred to the computing department, was engaged in the reduction of the hydrography of Wellfleet, $\frac{1}{80,000}$; currents of Cape Fear river; sketch of Sheldrake and Frying-Pan shoals; tracings and sections of the East river, Delaware river, &c.; a reduction of the hydrography of Albemarle sound, $\frac{1}{200,000}$; and in miscellaneous duties.

Mr. Hergesheimer has during the year executed the additional hydrography and notes for the manuscript map of Charleston harbor, scale $\frac{1}{10,000}$, including title and sailing directions; has completed the reduction of the topography of North Edisto, scale $\frac{1}{80,000}$, commenced by Mr. Walker; and has been employed on sketches for the annual report, and in miscellaneous duties. During the month of July he was in the field, attached to the plane-table party of Assistant H. L. Whiting.

Mr. Farquhar was connected with this department from December to April, during which time he reduced the hydrography of Salem harbor, scale $\frac{1}{25,000}$, enlarged the sheets covering the Delaware river in front of Philadelphia to a scale of $\frac{1}{5,000}$, and was occupied the remainder of his time in miscellaneous duties.

Mr. J. C. Tennent was transferred from the engraving to the drawing department July 1st, and has since been employed in miscellaneous duties connected with the charge of the records, in making projections and projects, and in special investigations.

Mr. Chas. Mahon has been employed during the year entirely on contract. He has reduced the topography of Salem harbor, scale $\frac{1}{25,000}$; the greater part of the topography and hydrography of the eastern sheet of Albemarle sound, scale $\frac{1}{80,000}$; the topography and hydrography of Newburyport harbor, scale $\frac{1}{30,000}$; and a sketch of Cuyler's harbor, scale $\frac{1}{20,000}$. He has also marked the limits and numbers of original sheets upon five sets of progress sketches for the use of the office.

Mr. John Lambert has been employed on contract in adding the topography to the sheet of the mouth of Columbia river, scale $\frac{1}{30,000}$; in reducing the same to a scale of $\frac{1}{40,000}$; and in reducing the sketch of Monterey bay $\frac{1}{40,000}$, (finished;) the topography of Chesapeake bay, $\frac{1}{80,000}$; Albemarle sound, $\frac{1}{200,000}$; and a sketch of Channel No. 4, Cedar Keys, $\frac{1}{30,000}$.

Mr. Francis Herbst has been employed during the year on contract in reducing the sketches of Beaufort harbor, Humboldt bay, Cape Hancock, San Diego bay, San Francisco bay, Galveston bay, Catalina harbor, St. Mark's and San Pedro harbors, and in reducing the topography of Chesapeake bay, $\frac{1}{400,000}$. He has also enlarged for the Board of Engineers for the Pacific coast the harbor of San Diego, to a scale of $\frac{1}{5,280}$, and has copied ten sheets of the entrance to San Francisco for the same board.

Mr. John R. Key has been employed on contract in making tracings and miscellaneous drawings.

Mr. Bernard Hooe, Jr., has been employed in making tracings, on contract, and in practice.

Mr. J. J. Lee was connected temporarily with the department from November, 1851, until May, 1852, and was occupied in the arrangement and care of the records and materials of the department, and in miscellaneous duties.

Mr. R. Middleton was employed from January to June in miscellaneous duties conected with the care of the records and materials.

Artificer A. Cassidy and Private J. A. Campbell, of Company A, sappers and miners, have been employed since May last in the care of the records and materials. A portion of their time has also been given to tracing and the practice of drawing.

3. ENGRAVING.—This department has since December last been under the supervision of Mr. A. W. Tinkham, assistant in the Coast Survey.

An amount of work has been accomplished during the year equal to the constant employment of twelve or thirteen engravers.

The additions to the list of finished, elaborately-engraved charts have amounted to three in number during the year: 1. General chart of the coast from Gay Head to Cape Henlopen, by Messrs. J. Knight, F. Dankworth, and G. McCoy; 2. Entrance to Mobile bay, by Messrs. H. M. Knight and G. McCoy; 3. Hell Gate and its approaches, by Messrs. J. Knight and G. McCoy. Besides the above, additions and alterations have been made to such an extent to three electrotypes as to transform them to the character of original plates, which either have been or will soon be electrotyped anew—lower sheet of Delaware bay, middle sheet of Long Island Sound series, and New Haven harbor.

A large number of preliminary charts and sketches have been engraved or completed during the year, some of them exceedingly valuable to the navigator. A list of them is herewith given:

1. Davis' South shoal, (5th edition,) by J. H. Goldthwaite, E. F. Woodward, and T. Donoho; 2. Changes in vicinity of Sandy Hook, by H. C. Evans and R. T. Knight; 3. Beacon ranges, New York harbor, by H. M. Knight and W. Smith; 4. Fishing or Donoho's Battery, Chesapeake bay, by T. H. Oehlschlager and W. Smith; 5. Entrance Chesapeake bay, by S. E. Stull; 6. Beaufort harbor, by T. Donoho, E. Yeager, and T. H. Oehlschlager; 7. Frying-Pan shoals, by J. H. Goldthwaite, H. C. Evans, and E. Yeager; 8. Reconnaissance Savannah river, in vicinity of Savannah, by J. V. N. Throop and H. M. Knight; 9. Entrance Savannah river, by R. T. Knight; 10. North Edisto river, by H. C. Evans and E. F. Woodward; 11. New river and bar, by J. H. Goldthwaite, T. Donoho, and T. H. Oehlschlager; 12. Key West, $\frac{1}{100}\cdot\frac{1}{600}$, by A. Rollé and E. Yeager; 13. St. Mark's, by S. E. Stull and T. H. Oehlschlager; 14. Channel No. 4, Cedar Keys, by S. E. Stull and T. H. Oehlschlager; 15. Rebecca shoal, by W. Smith; 16. Cat Island Tidal Diagrams, (edition of 1851,) by T. H. Oehlschlager, S. E. Stull, and E. Yeager; 17. Pass Christian, by J. V. N. Throop and H. M. Knight; 18. N. E. and S. E. Passes and Pass à l'Outre, Mississippi Delta, by H. M. Knight and E. F. Woodward; 19. Mobile bay, $\frac{2}{100}\cdot\frac{1}{600}$, by G. McCoy, H. M. Knight, H. C. Evans, T. H. Oehlschlager, and S. E. Stull; 20. Mare Island straits, by H. M. Knight; 21. Cata-

lina harbor, by A. Rollé, G. McCoy, and E. F. Woodward; 22. Monterey harbor, by S. Siebert and E. F. Woodward; 23. San Francisco city, by M. F. O. Strobel and E. F. Woodward; 24. Prisoners' harbor, Cuyler's harbor, and N.W. anchorage San Clemente, by M. F. O. Strobel and W. Smith; 25. San Pedro harbor, by H. C. Evans, M. F. O. Strobel, W. Smith, and G. McCoy; 26. Santa Cruz, San Simeon, San Luis Obispo, Points Conception and Coxo, by H. C. Evans, M. F. O. Strobel, and W. Smith; 27. San Francisco bay, (light-house sketch,) by S. Siebert and W. Smith; 28. Entrance to San Diego, by S. Siebert, G. McCoy, T. Donoho, E. Yeager, and S. E. Stull; 29. Humboldt bay, by G. McCoy, H. M. Knight, and W. Smith; 30. McArthur's reconnaissance, (third edition,) by G. McCoy; 31. Mouth of Columbia river, (second edition,) by G. McCoy and J. Knight; 32. Cape Hancock, by G. McCoy and W. Smith; 33. Sketch of electrotype apparatus in Coast Survey office, by J. C. Chambers; 34. Magnetic diagrams, by H. C. Evans and E. Yeager; 35—50. Progress and miscellaneous sketches by sundry engravers.

The engraving of the following charts has been continued: 1. Mobile bay, No. 2, by J. H. Goldthwaite; 2. South side Long Island, No. 2, by J. H. Goldthwaite; 3. Long Island sound, No. 1, by S. Siebert, G. McCoy, A. Rollé, J. Knight, and F. Dankworth; 4. Boston harbor, by A. Rollé, S. Siebert, and J. Knight; 5. Mouths of Connecticut river, by J. H. Goldthwaite and O. A. Lawson; 6. Charleston harbor, by E. Yeager and A. Rollé; 7. Muskeget channel, by S. E. Stull; 8. Seacoast of Delaware and Maryland, by S. E. Stull.

The engraving of the following charts has been commenced:

1. Wellfleet harbor, by S. E. Stull and S. Siebert; 2. Cape Fear river, by S. E. Stull and H. C. Evans; 3. Mobile bay, No. 1, by F. Dankworth; 4. North Edisto river, by H. C. Evans, E. F. Woodward, and T. H. Oehlschlager; 5. Salem harbor, by F. Dankworth and G. McCoy; 6. New Haven harbor, (electrotype No. 2,) by F. Dankworth; 7. Galveston entrance, by S. E. Stull and H. C. Evans.

The following preliminary charts and sketches are also in progress:

1. Davis' South shoal, (6th edition.)
2. Chincoteague inlet, and shoals in the vicinity.
3. Seacoast of Delaware and Maryland, and part of Virginia.
4. Chesapeake entrance, (re-engraving.)
5. Ocracoke inlet.
6. Hatteras inlet, (re-engraving.)
7. Key West, ~~1000·600~~, (2d edition.)
8. Mobile bay, ~~2000·600~~, (2d edition.)
9. South and Southwest Passes, Mississippi Delta.
10. Horn Island Pass.
11. Galveston bay, (2d edition.)
12. Reconnaissance of the western coast from San Diego to Sir Francis Drake's bay.
13. Santa Barbara.
14—29. Sixteen sketches, showing the progress of the survey.

4. ELECTROTYPING.—Under the skilful direction of Mr. Mathiot, the following engraved plates have been reproduced: 1. Mobile entrance; 2. Hell Gate, (two

copies;) 3. Richmond Island harbor, (two copies;) 4. No. 1, Delaware bay and river, (two copies;) 5. No. 2, Delaware bay and river, (three copies;) 6. No. 3, Delaware bay and river, (two copies;) 7. New York bay and harbor, (two copies;) 8. Hyannis harbor; 9. Pasquotank river; 10. View of Catalina harbor; 11. View of Point Pinos; 12. Catalina harbor; 13. Monterey harbor; 14. Views in Western Coast Reconnaissance, (two copies;) 15. General coast chart from Gay Head to Cape Henlopen. Twenty-eight metre-scales have been made for the use of office and field-parties, and fifty-nine blank copper-plates have been prepared for engraving. Many of these plates, some of large size, were made wholly by the electrotype process; the remainder were cut out from large plates and prepared for use. Mr. Mathiot has continued the inspection of all copper-plates purchased for the office, and has during the year completed the ocean thermometers commenced last year. He has also carefully prepared and put up for the United States Japan expedition a complete model of the electrotype apparatus, with all the appliances for its successful operation.

5. PRINTING.—Since the 1st of November, 1851, there have been printed from electrotypes Nos. 2 and 3 Delaware bay and river, 4,424 sheets, (this chart consists of three sheets;) from the small chart of New York bay and harbor, 708 sheets; from Hell Gate and approaches, 1,600 sheets; from the entrance of Mobile bay, 2,260 sheets; from the large New York chart plates, 300 sheets, (this chart contains six sheets;) from Richmond Island harbor, 2,618 copies; from Hart and City Island and Sachem's Head harbors, 200 copies; from Fisher's Island sound, 1,136 copies; from Hyannis harbor, 1,685 copies; from New London harbor, 145 copies; from Oyster or Syosset bay, 501 copies; from Huntingdon bay, 500 copies; from Pasquotank river, 340 copies; from the harbor of New Bedford, 412 copies; from Edgartown harbor, 210 copies; from Nantucket harbor, 200 copies; from Black Rock and Bridgeport, 334 copies; from Sheffield and Cawkin's islands, 56 copies; from Little Egg harbor, 338 copies; from Humboldt bay, 350 copies; from San Diego bay, 350 copies; from the mouth of Columbia river, 600 copies; from Hatteras shoals, 100 copies; from Cape Canaveral shoals, 130 copies; from Hatteras inlet, 100 copies; from Beaufort harbor, 100 copies; from western coast reconnaissance, 100 copies; from Davis' South shoal, 200 copies; from Catalina harbor, 800 copies; from Monterey harbor, 600 copies; from New river and bar, 100 copies; Channel No. 4, Cedar Keys, 100 copies; from Beacon ranges, 300 copies; Current diagram, 400; Tide diagram, 625; Alexander's barometer, 500; General coast chart, 30; Proofs of finished and unfinished plates, 2,213; and from annual sketches, 6,243—making in all 31,818 impressions. There have also been 450 sheets of antiquarian paper stretched for the use of draughtsmen. Also, Mr. D. McLellan, of New York, has taken 1,328 transfer impressions of Hell Gate; 3,262 of Western Coast Reconnaissance; 2,080 of Humboldt bay; 1,953 of San Diego entrance; and 2,178 of Trinidad bay. Also, transfer impressions of the following sketches, on thick paper, viz: 492 of Beaufort harbor; 496 of Mobile bay; 494 of Delta of the Mississippi; 500 of Galveston bay; and 478 of Key West.

From Mr. James Ackerman, of New York, the following sketches: 500 of Nantucket shoals; 500 of Frying-Pan shoals; 500 of North Edisto; 502 of

Entrance to Savannah river; 500 of West coast of Florida; 600 of Savannah city; 100 of Cape Fear triangulation; and 100 of Florida sub-sketches.

Also the following transfer impressions of sketches, on thin paper, were received from Mr. Ackerman: 250 of Boston harbor currents; 250 of Sandy Hook changes; 250 of Beacon ranges; 250 of Pot Rock and Way's reef; 250 of Chesapeake bay entrance; 224 of Fishing or Donoho's battery; 250 of Hatteras inlet; 250 of deep-sea or Gulf Stream soundings; 250 of Cape Fear river triangulation; 250 of Savannah river triangulation; 250 of North and South Edisto triangulation; 250 of Savannah city; 130 of Savannah entrance; 250 of Bull's bay; 250 of Florida sub-sketches; 250 of Cedar Keys; 250 of Horn Island Pass; 250 of Progress in Section IX; 250 of Aransas Pass; 250 of Point Conception; 250 of Point Pinos; 250 of San Francisco triangulation; 250 of San Diego triangulation; and 250 of Electrotype rooms and apparatus.

6. PUBLISHING.—At the date of the last report 33 sheets of Coast Survey maps had been published; since then 9 sheets have been added, making the number now published 42.

Since November, 1851, there have been distributed, by direction of the Treasury Department, and for use on the Survey, 186 sheets of the large map of New York bay and harbor, 147 sheets of Delaware bay and river, 62 copies of small map of New York bay and harbor, 20 copies of general coast chart, 48 copies of the harbor of New Bedford, 41 copies of Fisher's Island sound, 43 copies of the harbor of Annapolis and Severn river, 41 copies of the harbor of New Haven, 39 copies of Little Egg harbor, 39 copies of the harbor of Holmes' Hole and Tarpaulin cove, 38 copies of Oyster or Syosset bay, 58 copies of the harbor of New London, 42 copies of the harbor of Black Rock and Bridgeport, 42 copies of the harbor of Edgartown, 41 copies of the harbor of Sheffield and Cawkin's island, 43 copies of the harbor of Nantucket, 45 copies of the harbor of Captain's island, east and west, 42 copies of Huntingdon bay, 39 copies of the mouth of Chester river, 45 copies of Hyannis harbor, 42 copies of Pasquotank river, 45 copies of Cat and Ship Island harbor, 153 sheets of the Western Coast Reconnaissance, 800 copies of the western part of southern coast Long Island, 800 copies of Hart and City island and Sachem's Head harbor, 861 copies of Richmond island, 885 copies of Hell Gate, 812 copies of Mobile bay entrance, 54 copies of San Diego bay and approaches, 51 copies of Humboldt bay, 48 copies of Trinidad bay, 30 copies of mouth of Columbia river, 104 copies of Catalina harbor, and 13 copies of the bay of Monterey. The whole number of sheets distributed is 5,799.

There have also been distributed the following transfer impressions of sketches: 29 of Nantucket shoals; 40 of Beaufort harbor; 170 of Frying-Pan shoals; 125 of North Edisto; 157 of Entrance to Savannah river; 41 of West coast of Florida; 174 of Savannah city; 42 of Mobile bay; 42 of Delta of Mississippi; 183 of Galveston bay; 58 of Key West; 104 of Entrance to Chesapeake bay; 94 of Fishing or Donoho's battery; 126 of Hatteras shoals; 138 of Hatteras inlet; 197 of Bull's bay; 64 of Mosquito inlet; 35 of Rebecca shoals; 66 of Reconnaissance of vicinity of Cedar Keys; 59 of Pass Christian; 119 of Aransas

Pass; 56 of Mare Island straits; 67 of Point Conception; 67 of Point Pinos. The whole number of transfer sketches is 2,253.

There have been turned over to the disbursing officer of the Coast Survey, to be placed with agents for sale, 156 sheets of the large map of New York bay and harbor; 1,290 sheets of Delaware bay and river; 218 copies of small map of New York bay and harbor; 44 copies of the harbor of New Bedford; 23 copies of Fisher's Island sound; 23 copies of the harbor of Annapolis and Severn river; 35 copies of the harbor of New Haven; 28 copies of Little Egg harbor; 33 copies of the harbor of Holmes' Hole and Tarpaulin cove; 18 copies of Oyster and Syosset bay; 48 copies of the harbor of New London; 43 copies of the harbor of Black Rock and Bridgeport; 43 copies of the harbor of Edgartown; 33 copies of the harbor of Sheffield and Cawkin's island; 38 copies of the harbor of Nantucket; 33 copies of the harbor of Captain's island, east and west; 45 copies of Huntingdon bay; 23 copies of the mouth of Chester river; 40 copies of Hyannis harbor; 23 copies of Pasquotank river; 33 copies of Cat and Ship Island harbor; 84 sheets of the Western Coast Reconnaissance; 33 copies of the western part of southern coast of Long Island; 33 copies of Hart and City Island and Sachem's Head harbor; 48 copies of Richmond island; 78 copies of Hell Gate; 38 copies of Mobile bay entrance; 40 copies of San Diego bay and approaches; 48 copies of Humboldt bay; 40 copies of Trinidad bay; 27 copies of mouth of Columbia river—being in all 2,739 sheets of maps; also, the following transfer sketches: 3,000 of Western coast; 1,000 of Humboldt bay; 1,000 of San Diego bay and approaches, and 1,000 of Trinidad bay; 181 of Nantucket shoals; 55 of Beaufort harbor; 55 of Frying-Pan shoals; 55 of North Edisto; 55 of Entrance to Savannah river; 55 of West coast of Florida; 50 of Savannah city; 75 of Mobile bay; 60 of Delta of the Mississippi; 160 of Galveston bay; and 65 of Key West; being in all 6,866 sheets.

7. INSTRUMENT MAKING AND REPAIRING.—Under the direction of Mr. Joseph Saxton, all the necessary repairs, alteration, and adjustment of instruments used by the field parties, or in the office, have been made, including the repairing of fifteen theodolites, thirteen sextants, nine heliotropes, twelve plane-tables, eight metre chains, nine reconnoitring telescopes, eleven spy-glasses, one vertical circle, eight compasses, two sectors, one zenith sector, and one zenith telescope.

The following new instruments have been completed: six five-feet steel rules, two metre scales, four one-armed protractors, six common protractors, four beam-compasses, three plane-tables, three reconnoitring telescopes, (mounted,) six steel triangles, one brass triangle, seven self-registering tide-gauges, three deep-sea thermometers, and four magnets. Stands have also been made for two theodolites and one reconnoitring telescope.

Repairs have been made on a magnetic telegraph apparatus, and a hydraulic printing press is now in hand and nearly completed.

8. ARCHIVES AND LIBRARY.—These divisions have, during the past year, been under the charge of Mr. Chas. B. Snow. The duplicating and binding of the hydrographic works has been completed, new registers of the original topographical and hydrographical sheets have been made, and the sheets themselves re-arranged in

separate tubes. The library has been re-arranged and enlarged, and a new catalogue has been prepared.

Clerical force.—The charge of the clerical force of the office has been continued with Mr. J. J. Lee, assisted by Mr. Geo. W. Stevens; other persons also have been temporarily employed. Great improvement has been made in the methods of keeping the books of record and of registry, and a division of duties has been made which will, after somewhat more experience on the part of those employed, place this portion of the office in a very efficient condition.

The careful labors of Lieut. W. B. Whiting in the revision, under my immediate direction, of the hydrography of former years, of sailing directions, lists of dangers, and the like, and in occasional tidal work, were continued until he was relieved from Coast Survey service by the Navy Department, in January. Passed Midshipman Somerville Nicholson, who in like manner had been employed in tidal reductions in the office, was relieved in January, and Passed Midshipman Terrett, who took his place, was detached from the Survey before there was time for him to acquire any familiarity with the duties assigned him. There is an excellent opportunity for great usefulness in this division of the Survey; but it is essential that the officer should be attached to the office for a series of years to fill the position.

Brevet Captain G. W. Lay, U. S. Army, who was engaged in special service under my immediate direction, was detached from the Survey in October last.

The disbursements under the charge of Samuel Hein, Esq., have been made with their usual regularity and order. His promptness in answering all calls for information in regard to the accounts, and the method and order of his office, have continued to meet my entire approval.

Woods Baker, Esq., whose valuable assistance in the business and scientific details, made under my more immediate charge, I had occasion to acknowledge in my last report, was so seriously injured in the explosion of the boilers of the steamboat Reindeer, on the Hudson, as to survive the disaster but a few days. His high moral worth, mature judgment, scientific knowledge and training, rendered him exceedingly useful. I deplore his loss not less as a friend than as an able assistant. The estimation in which he was held by his associates is shown by their strong expressions of sorrow for his loss. (Appendix No. 31.)

P. B. Hooe, Esq., who succeeded to a part of the duties of Mr. Baker, has entitled himself to my acknowledgments for service rendered.

I have again the pleasure, in closing my report, to commend those engaged in the Coast Survey generally to the approval of the Treasury Department, under which they are serving.

Respectfully submitted, by

A. D. BACHE,
Superintendent of Coast Survey.

Hon. THOMAS CORWIN,
Secretary of the Treasury.

APPENDIX.

APPENDIX No. 1.

Distribution of the parties of the Coast Survey upon the coast of the United States during the surveying season of 1852–'53.

No. of section of survey.	Limits included in the several sections.	No. of parties in section.	Operations.	Persons conducting the operations.	Localities of the several operations.
I	Passamaquoddy bay to Point Judith, including the coast of Maine, New Hampshire, Massachusetts, and Rhode Island.	1	Primary triangulation.	A. D. Bache, Superintendent; Lieut. W. P. Trowbridge, Corps of Engineers, assistant.	Cape Small station, Maine: geodetic observations. (Part of season; see also Section III.)
		2	Longitude determinations.	S. C. Walker, assistant; L. F. Pourtales, assistant; and Professor W. C. Bond.	Determination of difference of longitude of Cambridge, Bangor, Me., and Halifax, by telegraph.
		3	Reconnaissance ...	C. O. Boutelle, assistant; and Bvt. Major Henry Prince, U. S. Army, assistant.	For extension of primary triangulation beyond Mt. Desert. (See also Sections IV and V.)
		4	Secondary triangulation and measurements of heights.	Capt. T. J. Cram, U. S. Top. Engrs., assistant; and Lieut. R. H. Rush, U. S. Army, assistant.	Secondary triangulation of coast of Maine and New Hampshire from the New Hampshire boundary to Saco river, Me.
		5	Secondary triangulation.	C. O. Boutelle, assistant; Lieut. W. R. Palmer, U. S. Top. Engrs., assistant; Geo. A. Fairfield, sub-assistant.	Casco bay, Me., including Portland harbor. (See also Section V.) (See also Section VI.)
		6	Topography	A. W. Longfellow, assistant.	Topography of seacoast of Maine, extending eastward, including Cape Elizabeth, towards Portland, Me.
		7	Topography	H. L. Whiting, assistant; R. M. Bache, sub-assistant; A. S. Wadsworth, sub-assistant; W. S. Walker, sub-assistant.	Topography of Cape Ann, including harbors of Essex and Annisquam. (See Section III.) (See also Sections II, IV, and VI.)
		8	Hydrography	Lt. Comg. C. H. McBlair, U. S. Navy, assistant.	Hydrography of Nantucket shoals, Fishing Rip, and off Gay Head completed.
		9	Hydrography	Lt. Comg. M. Woodhull, U. S. Navy, assistant.	Commencement of hydrography of Portland harbor, Me.; tides and currents of Vineyard and Nantucket sound, Annisquam harbor, Cape Ann.
		10	Tidal observations .	.....	Tidal observations in Boston harbor, Salem, Newburyport, Portland, Portsmouth, and Hyannis.
		11	Views	Lieut. A. A. Gibson, U. S. Army, assistant.	Entrances to Wood's & Quicks' Holes, Tarpaulin cove, Mattapoisett, and Sippican, and of Muskeget channel, and of Boston and Wellfleet harbors.
II	Point Judith to Cape Henlopen, including the coast of Connecticut, New York, New Jersey, Pennsylvania, and Delaware.	1	Primary triangulation.	J. E. Hilgard, assistant...	Astronomical and magnetic observations at Mount Rose, New Jersey. (See also Sections III and IV.)
		2	Triangulation	Edmund Blunt, assistant; Lieut. W. R. Palmer,* U. S. Top. Engrs., assistant; Lieut. A. H. Stewart, U. S. Army, assistant; W. E. Greenwell, assistant.	Triangulation of the Hudson river from the limits of former work. (See also Section III.) (*See also Section I, relieved by Mr. Greenwell.) (See also Section VIII.)
		3	Topography	R. M. Bache, sub-assistant.	Resurvey of the shore line of Sandy Hook (for the progress of Hook.) (See also Section I.)

APPENDIX No. 1—Continued.

No. of section of survey.	Limits included in the several sections.	No. of parties in section.	Operations.	Persons conducting the operations.	Localities of the several operations.
II	Point Judith to Cape Henlopen—Continued.	4	Hydrography	Lt. Comg. M. Woodhull, U. S. Navy, assistant.	Hydrography of the entrances of Dona and Mahon rivers, Del. (See also Section I.)
		5	Hydrography	.....	Tidal observations at Governor's island continued.
III	Cape Henlopen to Cape Henry, including the coast of Delaware, Maryland, and Virginia.	1	Triangulation and astronomical and magnetic observations.	A. D. Bache, superintendent; L. F. Pourtales, assistant; Geo. W. Dean, sub-assistant.	Observations of latitude, (by telegraph,) azimuth, magnetic variation, &c., at Roslyn station, near Petersburg, Va. (Part of season; see also Section I.)
		2	Astronomical observations.	L. F. Pourtales, assistant.	Observations of moon culminations at Seaton station, Washington. (See also Section I.)
		3	Primary and secondary triangulation.	Edmund Blunt, assistant; Lieut. W. R. Palmer, U. S. Top. Engrs., assistant; Lieut. A. H. Seward, U. S. Army, assistant.	Continuation of triangulation of Chesapeake bay and preliminary determinations to Cape Charles. (See also Sections I and II.)
		4	Primary and secondary triangulation.	John Farley, assistant; Geo. H. Bagwell, aid.	Continuation of the triangulation of the outer coast to the Capes, and its connexion with the Chesapeake work.
		5	Reconnaissance ...	John Farley, assistant ...	For the triangulation of the Appomattox river from Petersburg to City Point.
		6	Secondary and tertiary triangulation.	Lieut. W. P. Trowbridge, Corps of Engrs., assistant; Edward Goodfellow, aid.	Triangulation of the Appomattox river from Petersburg to City Point, and its connexion with the James river triangulation. (See also Section I.)
		7	Topography	John B. Glück, assistant; Wm. S. Walker, sub-assistant.	Work of revision on Patapsco.
		8	Topography	H. L. Whiting, assistant; A. Boschke, aid.	Verification work on Patapsco river; determination of wreck in Hooper's straits. (See also Sections I and VI.)
		9	Topography	John Seib, sub-assistant; S. A. Wainwright, sub-assistant.	Topography of the shores of the Appomattox from Petersburg to City Point, and revision of topography of Cove Point, north of Patuxent river.
		10	Topography	Geo. D. Wise, assistant...	Topography of the outer shore of the peninsula, eastern shore of Maryland and Virginia, from South Gargathy to Cape Charles, nearly completed.
		12	Hydrography.....	Lieut. Comg. J. J. Almy, U. S. Navy, assistant.	Hydrography of the outer coast of Maryland and Virginia to Matchipungo inlet; of the Chesapeake, north from Cape Charles; and of Capes of Fisherman's bay.
		13	Hydrography.....	Lt. Comg. R. Wainwright, U. S. Navy, assistant.	Hydrography of the Appomattox river from Petersburg to City Point and Harrison's bar, James river. (See also Section IV.)
		14	Hydrography.....	.....	Tidal observations at Old Point Comfort, Va., continued.
		15	Inspection of parties.	A. D. Bache, superintendent.	Inspection of parties and general reconnaissance of James and Appomattox rivers.
		16	Inspection of parties.	Bvt. Major I. I. Stevens, U. S. Corps of Engrs., assistant.	Inspection of topographical work on Patapsco.

APPENDIX No. 1—Continued.

No. of section of survey.	Limits included in the several sections.	No. of parties in section.	Operations.	Persons conducting the operations.	Localities of the several operations.
IV	Cape Henry to Cape Fear, coast of part of Virginia and North Carolina.	1	Reconnaissance ...	Bvt. Major Henry Prince, U. S. Army, assistant.	From Cape Henry, Va., south, to Currituck sound, N. C. From Cape Fear river, northward, to New river, N. C. (See also Section I.)
		2	Secondary triangulation and topography.	J. J. S. Hassler, assistant.	Triangulation and topography of the shores of Currituck sound, north, nearly to the Virginia line.
		3	Secondary triangulation and topography.	C. P. Bolles, assistant; J. W. Gregorie, sub-assistant.	Triangulation and topography of the Cape Fear entrance and approaches. (See also Section V.)
		4	Tertiary triangulation.	A. S. Wadsworth, sub-assistant; Chas. T. Jardella, aid.	From Hatteras inlet to Ocracoke, and from Beaufort harbor, westward, to include Core sound, N. C. (See also Section I.)
		5	Topography	I. H. Adams, sub-assistant	Topography from Core Point, Bodie's island, to Garr island, Hatteras inlet, and completion of topography of Nag's Head.
		6	Hydrography	Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant.	Running off-shore lines from Cape Henlopen, in Sections III and IV; hydrography of Cape Roman shoals, S. C., and shoals from Santee river to Winyaw bay; placing Hatteras bell-beacon. (See also Section IX.)
		7	Hydrography	Lieut. Comg. J. N. Maffitt, U. S. Navy, assistant.	Hydrography of Cape Fear entrance and New inlet, New river. (See also Section V.)
		7	Hydrography	Lt. Comg. R. Wainwright, U. S. Navy, assistant.	Hydrography of Currituck sound and of Hatteras and Ocracoke inlets, N. C. (See also Section III.)
V	Cape Fear to St. Mary's river, including the coast of South Carolina and Georgia.	1	Primary and secondary triangulation.	C. O. Boutelle, assistant; J. W. Gregorie, sub-assistant.	Primary triangulation from Edisto base to Charleston; secondary triangulation of the Edisto, Dawho, Wadmelaw, and Kiawah rivers. (See also Section I.)
		2	Secondary triangulation.	C. P. Bolles, assistant; J. R. Offley, aid.	Secondary triangulation of Savannah river from Fort Pulaski to head of Argyle island.
		3	Topography	H. L. Whiting, assistant; W. S. Walker, sub-assistant.	Topography of shores of Savannah river within the limits of the triangulation. (See also Section I.)
		4	Hydrography	Lieut. Comg. J. N. Maffitt, U. S. Navy, assistant.	Hydrography of the Savannah river as far as triangulated; examinations of Charleston bars; light-house examination at Georgetown harbor, S. C. (See also Section IV.)
		5	Views.....	Lieut. A. A. Gibson.....	Views of Charleston harbor entrance.
		6	Inspection of parties.	A. D. Bache, superintendent.	Inspection of parties and general reconnaissance of Savannah river above Savannah.
		7	Magnetic observations.	J. E. Hilgard, assistant ..	Magnetic observations at Savannah and Tybee light.
VI	From St. Mary's river to St. Joseph's, coast of Florida.	1	Main triangulation.	Lieut. James Totten, U. S. Army, assistant; E. F. Mason, aid.	Extension of triangulation of Florida reef and keys from Cape Florida, south, to Point Elizabeth: erection of screw-pile signals along the reef.

APPENDIX No. 1—Continued.

No. of section of survey.	Limits included in the several sections.	No. of parties in section.	Operations.	Persons conducting the operations.	Localities of the several operations.
VI	From St. Mary's river to St. Joseph's—Continued.	2	Secondary triangulation.	Lieut. Jos. S. Totton, U. S. Army, assistant; G. A. Fairfield, sub-assistant.	Inside triangulation of the reef, including Walker keys, down to Barnes' sound. (See also Section I.)
		3	Hydrography	Lt. Comg. John Rodgers, U. S. Navy, assistant.	Hydrography of Key West harbor; of the reef from Narrows cut to Triumph reef; of Legaré harbor of refuge; of Rebecca shoals, and vicinity of Key Biscayne.
		4	Hydrography	J. W. Goss	Hourly observations of tides at Key West.
VII	From St. Joseph's bay to Mobile bay, including part of the coast of Florida and Alabama.	1	Reconnaissance ...	F. H. Gerdes, assistant ..	Reconnaissance from the mouth of Suwanee river to the mouths of the Mississippi, including the whole of the coast of this section.
		2	Astronomical observations.	J. E. Hilgard, assistant; G. H. Bagwell, aid.	Observations of latitude and azimuth, and for longitude and magnetic observations, at Cedar Keys and St. Mark's. (See also Sections III and IV.)
		3	Triangulation and topography.	F. H. Gerdes, assistant; H. Ginder, aid; J. S. Oltmans, aid.	Triangulation of approaches to Cedar Keys channel, and topography connected with it.
VIII	From Mobile bay to Vermillion bay, including the coast of Alabama, Mississippi, and part of Louisiana.	1	Reconnaissance ...	F. H. Gerdes, assistant ..	Reconnaissance continued from Suwanee river, Section VI, to the mouths of the Mississippi in this section. (See also Sections VI and VII.)
		2	Triangulation	S. A. Gilbert, assistant; C. M. Bache, aid.	Triangulation from Cat island, westward, over Lake Borgne, to include eastern end of Lake Pontchartrain, and hydrographic survey of Milneburg harbor, Lake Pontchartrain.
		3	Topography	W. E. Greenwell, assistant; W. M. Johnson, aid.	Topography from Montgomery triangulation station to Malheureux Point, on Lake Borgne, north end of Chandeleur island. (See Section II.)
		4	Hydrography	Lieut. Comg. B. F. Sands, U. S. Navy, assistant in Coast Survey.	Hydrography of Horn Island Pass, Naso roads, off Chandeleur island, part of Mississippi sound, outside work off Dauphine island, west of Mobile entrance, and reconnaissance of the South and Southwest Passes of the Mississippi.
		5	Hydrography	Gus. Würdeman.....	Observations of tides at mouths of the Mississippi.
IX	From Vermillion bay to the boundary, including part of the coast of Louisiana and the coast of Texas.	1	Reconnaissance ...	Jas. S. Williams, assistant.	Reconnaissance for the secondary triangulation continued to embrace the eastern portion of Matagorda bay.
		2	Secondary triangulation.	Jas. S. Williams, assistant; S. C. McCorkle, sub-assistant; Edw'd Goodfellow, aid.	Continuation of the triangulation from Velasco to Cedar lakes.
		3	Topography	J. M. Wampler, sub-assistant; G. W. Parish, aid.	Continuation of topography from West island base to Jupiter station.

APPENDIX No. 1—Continued.

No. of section of survey.	Limits included in the several sections.	No. of parties in section.	Operations.	Persons conducting the operations.	Localities of the several operations.
IX.	From Vermillion bay to the boundary—Continued.	4	Hydrography	Lt. Comg. T. A. M. Craven, U. S. Navy, assistant.	Hydrography of Half-moon shoal; hydrography of Upper bay nearly completed; tidal and current observations. (See also Sections IV and V.)
		5	.....	F. Mühr	Hourly tidal observations at Galveston.
X & XI	Western coast of the United States, Oregon and California.	1	Main and secondary triangulation.	R. D. Cutts, assistant; Jos. S. Ruth, sub-assistant.	Completion of triangulation of San Francisco bay, and triangulation of Monterey harbor, Cal., and of the Columbia river, Oregon, for 35 miles from Cape Disappointment.
		2	Geographical determinations.	Geo. Davidson, assistant; Mr. James S. Lawson, aid.	Latitude and longitude of Point Pinos, San Diego, Monterey, San Simeon, San Luis Obispo, Santa Barbara, Prisoner's harbor, San Pedro, San Clemente, San Nicolas, Santa Catalina, False Dungeness, and Pt. Hudson, and longitude of Point Conception and Cuyler's harbor, Cal., and Cape Disappointment, Oregon Territory.
		3	Topography	R. D. Cutts, assistant; A. S. Rodgers, sub-assistant.	Topography of Monterey, coast north and south of San Francisco entrance, Yerba Buena and Angel islands, and Contra Costa.
		4	Topography	A. M. Harrison, sub-assistant; Jno. Rockwell, sub-assistant.	Topography of Point Conception, San Diego, False bay, Santa Barbara, San Francisco bay, Cal., and of Cape Hancock, Point Adams, Sand island, and Ewing harbor, Oregon.
		5	Topography	Mr. James S. Lawson....	Topography of Cape Flattery and of points determined by Assistant George Davidson.
		6	Hydrography	Lt. Comg. James Alden, U. S. Navy, assistant.	Hydrography of San Francisco, Monterey, San Diego, Humboldt and Cuyler's harbors, Columbia river entrance, and hydrographic reconnaissances from Monterey, south, to San Diego, including the Santa Barbara islands and channel; from Columbia river, north, to Port Townsend, entrance to Puget's sound, and revision of former reconnaissance from San Francisco to Columbia river.

APPENDIX No. 2.

List of army officers on Coast Survey duty July 1, 1852.

Name.	Rank.	Date of attachment.
Thos. J. Cram	Captain topographical engineers	December 7, 1846
Henry Prince	Captain and brevet major 4th infantry	December 10, 1850
Isaac I. Stevens	First lieutenant and brevet major engineers	September 14, 1849
W. R. Palmer	First lieutenant topographical engineers	March 2, 1852
Augustus A. Gibson	First lieutenant 2d artillery	January 17, 1851
James Totten	do do	December 10, 1850
Richard H. Rush	do do	do do
Jos. S. Totten	do do	do do
George W. Lay	First lieutenant and brevet captain 6th infantry	do do
Edward B. Hunt	Second lieutenant engineers	May 5, 1851
John G. Foster	Second lieutenant and brevet captain engineers	March 20, 1852
Augustus H. Seward	Second lieutenant 5th infantry	December 8, 1851
Wm. P. Trowbridge	Second lieutenant engineers	April 18, 1851

APPENDIX No. 2 *bis*.

List of army officers on Coast Survey duty January 1, 1853.

Name.	Rank.	Date of attachment.
Thos. J. Cram	Captain topographical engineers	December 7, 1846
Henry Prince	Captain and brevet major 4th infantry	December 10, 1850
Edward O. C. Ord	Captain 3d artillery	December 30, 1852
Isaac I. Stevens	First lieutenant and brevet major engineers	September 14, 1849
Wm. R. Palmer	First lieutenant topographical engineers	March 2, 1852
Augustus A. Gibson	First lieutenant 2d artillery	January 17, 1851
James Totten	do do	December 10, 1850
Jos. S. Totten	do do	do do
Daniel T. Van Buren	do do	December 2, 1852
Edward B. Hunt	Second lieutenant engineers	May 5, 1851
John G. Foster	Second lieutenant and brevet captain engineers	March 20, 1852
Augustus H. Seward	Second lieutenant 5th infantry	December 8, 1851
Wm. P. Trowbridge	Second lieutenant engineers	April 18, 1851
Andrew W. Evans	Brevet second lieutenant 7th infantry	November 10, 1852

APPENDIX No. 3.

List of naval officers on Coast Survey duty July 1, 1852.

Vessel.	Locality of service.	Name.	Rank.	Date of attachment.
Steamer Corwin and schooner Nautilus.	Section I	Chas. H. McBlair	Lieutenant commanding	April 11, 1849.
		Geo. W. Doty	Lieutenant	May 1, 1851.
		Thos. B. Huger	do	May 14, 1852.
		Bayse N. Westcott	do	April 3, 1852.
		Jacob S. Dungan	Assistant surgeon	May 12, 1852.
		Paul Shirley	Acting master	May 12, 1848.
		W. E. Hopkins	Passed midshipman	May 14, 1852.
		Robt. A. Marr	do do	May 29, 1851.
		J. Walcutt	do do	May 14, 1852.
		F C. Dade	Third assistant engineer	May 14, 1852.
		Jameson C. Hull	do do	May 14, 1852.
		Hiram Haines	do do	May 14, 1852.
Schooners Madison and Vanderbilt.	Section I	Maxwell Woodhull	Lieutenant commanding	March 30, 1848.
		G. H. Preble (Vanderbilt)	Lieutenant	August 21, 1851.
		John Rutledge	do	March 3, 1852.

APPENDIX No. 3—Continued.

Vessel.	Locality of service.	Name.	Rank.	Date of attachment.
Schooners Madison and Vanderbilt.	Section I.....	Wm. A. Nelson	Passed assistant surgeon....	March 14, 1852.
		Wm. Gibson	Acting master.....	November 29, 1848
Steamer Hetzell and schooner Graham.	Section III.....	John J. Almy	Lieutenant commanding	March 12, 1851.
		Thos. M. Crossan.....	Lieutenant	May 1, 1851.
		James F. Harrison	Assistant surgeon.....	April 6, 1852.
		Richard L. Law.....	Acting master.....	May 1, 1851.
		Thos. S. Phelps	Passed midshipman	May 5, 1847.
		W. King Bridge	....do.....do.....	May 25, 1852.
		W. Reily	....do.....do.....	April 2, 1852.
		Sylvanus J. Bliss	....do.....do.....	April 2, 1852.
		James M. Adams.....	Second assistant engineer...	June 7, 1850.
		W. T. Gorton.....	Third assistant engineer	April 7, 1852.
		Lloyd A. Williams.....	....do.....do.....	April 7, 1852.
Schooner John Y. Mason.	Section III.....	Richard Wainwright	Lieutenant commanding	January 31, 1848.
		E. Brinley.....	Passed midshipman.....	March 8, 1852.
		W. H. Murdaugh.....	....do.....do.....	March 8, 1852.
		Thos. Young	....do.....do.....	March 8, 1852.
Schooner Crawford...	Section IV	John N. Maffitt	Lieutenant commanding	May 9, 1843.
		A. C. Rhind	Passed midshipman.....	June 20, 1845.
		J. P. Jones	....do.....do.....	June 28, 1852.
		J. D. Langhorne	....do.....do.....	May 20, 1850.
		Edwin C. Carnes	....do.....do.....	June 23, 1852.
Steamer Legaré	Section VI.....	John Rodgers.....	Lieutenant commanding	April 27, 1849.
		J. Dorsey Read.....	Lieutenant	October 28, 1850.
		J. M. B. Clitz	....do.....	December 22, 1851.
		Danl. L. Bryan	Passed assistant surgeon....	December 26, 1851.
		Julian Myers	Acting master.....	November 11, 1849.
		M. P. Jones.....	Passed midshipman	August 17, 1850.
		Greenleaf Cilley.....	....do.....do.....	February 7, 1851.
		Hunter Davidson.....	....do.....do.....	January 17, 1852.
		W. H. King	Second assistant engineer...	May 2, 1851.
		W. J. Lamdin	Third assistant engineer	May 16, 1851.
		Geo. E. DeLuce	....do.....do.....	May 16, 1851.
Steamer Walker	Section VIII	B. F. Sands.....	Lieutenant commanding	May 14, 1850.
		C. M. Morris	Lieutenant	December 2, 1851.
		W. S. Bishop	Passed assistant surgeon....	May 1, 1851.
		W. Roberts.....	Acting master.....	September 6, 1848.
		J. B. McCauley	Passed midshipman	October 16, 1850.
		Wm. L. Powell	....do.....do.....	August 12, 1851.
		S. S. Bassett.....	....do.....do.....	March 17, 1849.
		R. H. Long.....	Second assistant engineer...	March 13, 1849.
		R. C. Potts	....do.....do.....	January 1, 1851.
		George F. Barton	Third assistant engineer	January 10, 1852.
		Cornelius T. Parke	....do.....do.....	October 9, 1851.
Schooners Morris and Belle.	Section IX	T. A. M. Craven	Lieutenant commanding	November 27, 1850.
		John C. Febiger.....	Acting master.....	December 3, 1851.
		Leonard H. Lyne.....	Passed midshipman	September 26, 1850.
		W. Van Wyck	....do.....do.....	March 19, 1851.
Steamer Active	Sections X and XI.	James Alden, jr.	Lieutenant commanding	May 18, 1849.
		Thos. H. Stevens	Lieutenant	February 21, 1851.
		J. C. Wait.....	....do.....do.....	May 6, 1852.
		W. B. Muse	....do.....do.....	May 6, 1852.
		J. S. Kennard.....	....do.....do.....	May 6, 1852.
		R. M. Cuyler	Acting lieutenant	June 20, 1845.
		James Suddards.....	Assistant surgeon.....	April 3, 1852.
		E. A. Whipple	Second assistant engineer...	April 10, 1852.
		W. A. R. Latimer	Third assistant engineer	April 10, 1852.
		Henry C. Jewell	....do.....do.....	June 17, 1852.
	Office	Saml. Swartwout	Lieutenant	May 1, 1851.
		Thornton A. Jenkins*	....do.....do.....	March 16, 1849.
	Office	A. S. Baldwin	....do.....do.....	January 20, 1851.
	Office	W. B. Whiting.....	....do.....do.....	May 22, 1837.
	Office	Montgomery Hunt	....do.....do.....	October 16, 1851.
	Europe	W. A. Bartlett†.....	....do.....do.....	November 29, 1848.
	Office.....	A. G. Pendleton.....	Professor of mathematics...	May 8, 1848.

* Secretary of the Light-house Board. † Special agent of the Treasury Department in Europe, on light-house duty.

APPENDIX No. 3 *bis*.

List of naval officers on Coast Survey duty January 1, 1853.

Vessel.	Locality of service.	Name.	Rank.	Date of attachment.
Schooner John Y. Mason.	Section III.....	R. Wainwright.....	Lieutenant commanding....	January 31, 1848.
		Edward Brinley, jr.....	Passed midshipman.....	March 8, 1852.
		John B. Stewart.....	....do.....do.....	November 15, 1852.
		Thos. Young.....	....do.....do.....	March 8, 1852.
Schooner Crawford...	Sections IV and V..	J. N. Maffitt.....	Lieutenant commanding....	May 9, 1843.
		A. C. Rhind.....	Acting master.....	June 20, 1845.
		J. P. Jones.....	Passed midshipman.....	June 28, 1852.
		J. C. P. DeKrafft.....	....do.....do.....	December 22, 1852.
		J. D. Langhorne.....	....do.....do.....	May 20, 1850.
		J. C. Hamilton.....	....do.....do.....	August 31, 1852.
Steamer Corwin and tender Angle.	Section VI.....	T. A. M. Craven.....	Lieutenant commanding....	November 27, 1850.
		B. N. Westcott.....	Lieutenant.....	April 3, 1852.
		J. S. Dungan.....	Assistant surgeon.....	May 12, 1852.
		John C. Febiger.....	Acting master.....	December 3, 1851.
		Julian Myers.....	.....do.....	November 11, 1849.
		Jos. B. Smith.....	Passed midshipman.....	August 4, 1852.
		Thos. C. Eaton.....	....do.....do.....	July 23, 1852.
		F. C. Dade.....	Second assistant engineer...	May 14, 1852.
		Hiram Haines.....	Third assistant engineer....	May 14, 1852.
		J. C. Hull.....	....do.....do.....	May 14, 1852.
Steamer Walker.....	Section VIII.....	B. F. Sands.....	Lieutenant commanding....	May 14, 1850.
		Geo. W. Doty.....	Lieutenant.....	May 1, 1851.
		T. B. Huger.....	....do.....	May 14, 1852.
		W. S. Bishop.....	Passed assistant surgeon....	May 1, 1851.
		J. B. McCauley.....	Acting master.....	October 16, 1850.
		J. M. Bradford.....	Passed midshipman.....	November 17, 1852.
		S. S. Bassett.....	....do.....do.....	March 17, 1849.
		R. C. Duvall.....	....do.....do.....	November 17, 1852.
		A. C. Stimers.....	Second assistant engineer...	November 18, 1852.
		W. H. Nones.....	....do.....do.....	August 3, 1852.
		C. Lindsley.....	Third assistant engineer....	November 18, 1852.
		Geo. E. Shock.....	....do.....do.....	November 18, 1852.
Schooners Morris and Belle.	Section IX.....	H. S. Stellwagen.....	Lieutenant commanding....	October 22, 1852.
		John Wilkinson.....	Lieutenant.....	November 12, 1852.
		M. P. Jones (Morris).....	Acting master.....	August 17, 1850.
		L. H. Lyne (Belle).....	.....do.....	September 26, 1850.
		Hunter Davidson.....	Passed midshipman.....	January 17, 1852.
		Chas. Gray.....	....do.....do.....	November 12, 1852.
		George S. King.....	....do.....do.....	November 12, 1852.
Steamer Active.....	Sections X and XI.	James Alden.....	Lieutenant commanding....	May 18, 1849.
		Thos. H. Stevens.....	Lieutenant.....	February 21, 1851.
		J. C. Wait.....	....do.....	May 6, 1852.
		W. B. Muse.....	....do.....	May 6, 1852.
		J. S. Kennard.....	....do.....	May 6, 1852.
		R. M. Cuyler.....	Acting lieutenant.....	June 20, 1845.
		James Suddards.....	Assistant surgeon.....	April 3, 1852.
		Saml. Magard.....	Passed midshipman.....	May 26, 1852.
		E. A. Whipple.....	Second assistant engineer...	April 10, 1852.
		H. C. Jewett.....	Third assistant engineer....	June 17, 1852.
		W. A. R. Latimer.....	....do.....do.....	April 10, 1852.
	Office.....	John J. Almy.....	Lieutenant commanding....	March 12, 1851.
	Office.....	R. L. Law.....	Passed midshipman.....	May 1, 1851.
	Office.....	Maxwell Woodhull.....	Lieutenant commanding....	March 30, 1848.
	Office.....	John Rutledge.....	Lieutenant.....	May 3, 1852.
	Office.....	A. W. Habersham.....	Passed midshipman.....	December 4, 1852.
		Thornton A. Jenkins*....	Lieutenant.....	March 10, 1849.
	Office.....	W. B. Whiting.....	....do.....	March 22, 1837.
	Europe.....	W. A. Bartlett†.....	....do.....	November 29, 1848.
	Office.....	A. N. Smith.....	Passed midshipman.....	August 4, 1852.
	Office.....	Colville Terrett.....	....do.....do.....	November 10, 1852.
	Office.....	A. G. Pendleton.....	Professor of mathematics...	May 8, 1848.
	In charge of steamer Hetzell.	James M. Adams.....	Third assistant engineer....	June 7, 1850.

* Secretary of the Light-house Board. † Special agent of the Treasury Department in Europe, on light-house duty.

APPENDIX No. 4.

Results of the Coast Survey at different periods from 1844 *to* 1852.

	Previous to 1844.	From 1844 to 1851.	For 1851.	Total from beginning of survey.
Reconnaissance—Area, in square miles	9,642	27,036	3,512	40,190
Parties, number of	.....	.....	4	4
Base lines—Number of	1	5	.....	6
Preliminary, number of	2	11	3	16
Length of, in miles	19½	62	2	83½
Triangulation—Area, in square miles	9,076	14,829	2,465	26,370
Extent of coast line, in miles	310	859	117	1,286
Extent of shore line, in miles	3,215	5,733	694	9,642
Horizontal angle stations, number of	750	976	184	1,910
Points determined ..... do	1,183	1,701	307	3,191
Vertical angle stations ..... do	15	49	22	86
Heights determined ..... do	44	191	53	288
Astronomical stations—Azimuth, number of	9	26	6	41
Latitude ..... do	9	36	8	53
Longitude ..... do	1	20	7	28
Latitude, extra, number of	.....	.....	.....	.....
Longitude, extra, ... do	.....	.....	5	5
Magnetic stations, number of	.....	106	10	116
Triangulation parties, number of	.....	.....	14	14
Astronomical parties ..... do	.....	.....	6	6
Magnetic parties ..... do	.....	.....	2	2
Topography—Area, in square miles	6,222	3,399	568	10,189
Length of shore line, in miles	6,100	5,173	722	11,995
Topographical parties, number of	.....	.....	12	12
Hydrography—Area, in square miles	9,623	18,550	2,400	30,573
Parties, number of	.....	.....	10	10
Soundings, number of	808,147	1,480,349	371,660	2,660,156
Soundings in Gulf Stream for temperature	.....	1,434	21	1,455
Fathoms of line used in same	.....	140,661	2,447	143,108
Tidal stations, number of	108	148	26	282
Tidal parties ..... do	.....	.....	7	7
Current parties ..... do	.....	.....	3	3
Current stations ..... do	.....	280	41	321
Specimens of bottom, number of	1,327	4,040	305	5,672
Topographical maps, (original,) number of	166	149	38	353
Hydrographical maps, (original,) number of	127	125	47	299
Reductions and other maps	326	409	208	943
Total number of manuscript maps	453	534	255	1,242
Records of triangulation, (original,) number of volumes	97	100	33	230
Records, astronomical ..... do ..... do ..... do	17	108	41	166
Records, magnetic ..... do ..... do ..... do	4	37	5	46
Duplicates of the above ..... do ..... do	27	205	45	277
Computations ..... do ..... do	78	118	40	236
Hydrographical books, sounding and angle observations, original, number of volumes	188	777	213	1,178
Hydrographical books, sounding and angle observations, duplicates ..... do ..... do	28	54	16	98
Hydrographical books, tidal and current observations, original ..... do ..... do	127	385	114	626
Hydrographical books, tidal and current observations, duplicates ..... do ..... do	.....	214	385	599
Hydrographical books, tidal reductions ..... do ..... do	.....	198	22	220
Total records ..... do ..... do	566	2,191	914	3,671
Library ..... do ..... do	.....	1,340	333	1,673
Engraved plates of maps, number of	5	34	6	45
Engraved plates electrotyped, number of	.....	37	18	55
Published maps, number of	.....	31	6	37
Printed sheets of maps distributed, number of	.....	9,852	5,649	15,501
Do ..... do ..... sale agents ..... do	.....	22,909	5,168	28,077
Total number of printed sheets	.....	46,184	10,817	57,001
Instruments, value of	.....	$162,491	$4,603	$167,094

APPENDIX No. 5.

List of Coast Survey discoveries and developments.

The true object of the survey is to furnish charts of the coast for the purposes of commerce. In preparing these, important discoveries are frequently made. The following are among the developments of the past year, (1852:)

1. Fishing Rip, a large shoal lying about ten miles to the eastward of Davis' Bank and thirty miles distant from Nantucket. It extends nearly north and south, and has but four and a half fathoms water upon it in places.

2. Two channels into Watchapreague inlet, seacoast of Virginia—one from the northward and the other from the eastward—both with seven feet water at low tide.

3. Great Matchipungo inlet, found to have a fine wide channel, with eleven feet water on the bar at low water and fourteen feet at high water; good anchorage inside in from two to eight fathoms; the best harbor between the capes of the Chesapeake and the Delaware.

4. A shoal half a mile in extent, situated due east from the north end of Paramore's island, seacoast of Virginia, and distant five and a half miles from shore; it has but four fathoms water upon it, while around it the soundings are nine fathoms. It is not put down on any chart.

5. The true position and extent of the dangerous shoals in the vicinity of Chincoteague inlet, seacoast of Virginia.

6. Metomkin inlet having shoaled during the past year, from eleven to eight feet of water in the channel.

7. Only three feet water upon the "Inner Middle," the shoal part of the Middle Ground west of the "north channel," at the entrance of the Chesapeake bay.

8. A twenty-five fathom hole two and a half miles W. S. W. from Tazewell triangulation point, eastern shore of Chesapeake bay; all other charts give not more than sixteen fathoms in this vicinity.

9. A new channel, with fourteen feet water, into Hatteras inlet, formed during the year. It is better and straighter than the old channel.

10. Changes in the channels at the entrance of Charleston harbor, S. C.

11. Shoaling of Cape Fear River bar—thoroughly examined for purposes of improvement.

12. A new passage, with three fathoms water, through the Florida reef to Legaré harbor, under Triumph reef (lat. 25° 30′, long. 80° 03′ west,) which, if properly buoyed, would be valuable as a harbor of refuge.

13. Isaac shoal, near Rebecca shoal, Florida reef; not laid down on any chart.

14. A northwest entrance into Cedar Keys bay, called Channel No. 4.

15. The changes in the channels at the mouth of the Columbia river, Oregon; their tendency to the southward; with the formation of a new three-fathom channel from Point Hancock due west to open water.

16. Changes in the channel at the entrance of Humboldt bay.

17. A shoal inside of Ballast point, San Diego bay, with twelve and a half feet of water upon it; not laid down on any chart.

APPENDIX No. 6.

List of Coast Survey maps, sketches, and preliminary charts engraved and engraving.

1. LIST OF MAPS ENGRAVED.

No. 1.	New York bay and harbor and the environs—Sheet No. 1	$\frac{1}{30000}$
2.	....Do.....do.....do.....do.....do.... 2	$\frac{1}{30000}$
3.	....Do.....do.....do.....do.....do.... 3	$\frac{1}{30000}$
4.	....Do.....do.....do.....do.....do.... 4	$\frac{1}{30000}$
5.	....Do.....do.....do.....do.....do.... 5	$\frac{1}{30000}$
6.	....Do.....do.....do.....do.....do.... 6	$\frac{1}{30000}$
7.	Delaware bay and river—Sheet No. 1	$\frac{1}{80000}$
8.	....Do.....do.....do.....2	$\frac{1}{80000}$
9.	....Do.....do.....do.....3	$\frac{1}{80000}$
10.	New York bay and harbor, and the environs	$\frac{1}{80000}$
11.	Harbor of New Bedford	$\frac{1}{40000}$
12.	Fisher's Island sound	$\frac{1}{40000}$
13.	Harbor of Annapolis and Severn river	$\frac{1}{60000}$
14.	Harbor of New Haven	$\frac{1}{30000}$
15.	Little Egg harbor	$\frac{1}{30000}$
16.	Harbors of Holmes' Hole and Tarpaulin cove	$\frac{1}{20000}$
17.	Harbor of New London	$\frac{1}{20000}$
18.	Harbors of Black Rock and Bridgeport	$\frac{1}{20000}$
19.	Harbor of Edgartown	$\frac{1}{20000}$
20.	Harbors of Sheffield and Cawkins' island	$\frac{1}{20000}$
21.	Harbor of Oyster or Syosset bay	$\frac{1}{30000}$
22.	Nantucket harbor	$\frac{1}{20000}$
23.	Harbors of Captain's island, east and west	$\frac{1}{20000}$
24.	Huntingdon bay	$\frac{1}{30000}$
25.	Mouth of Chester river	$\frac{1}{60000}$
26.	Hyannis harbor	$\frac{1}{30000}$
27.	Pasquotank river	$\frac{1}{60000}$
28.	Cat and Ship Island harbor	$\frac{1}{40000}$
29.	Western part of south coast of Long Island	$\frac{1}{80000}$
30.	Hart and City island and Sachem's Head harbor	$\frac{1}{20000}$, $\frac{1}{10000}$
31.	Richmond island	$\frac{1}{20000}$
32.	Hell Gate	$\frac{1}{5000}$
33.	Mobile bay entrance	$\frac{1}{10000}$
34.	General chart of the coast from Gay Head to Cape Henlopen	$\frac{1}{400000}$

2. LIST OF SKETCHES AND PRELIMINARY CHARTS ENGRAVED.

No. 1.	Western Coast reconnaissance from Monterey to mouth of Columbia river	Sheet No. 1—third edition.
2.	.....Do.....do.....do..Sheet No. 2.....do.	
3.	.....Do.....do.....do..Sheet No. 3.....do.	
4.	San Diego bay and approaches	$\frac{1}{25000}$
5.	Humboldt bay	$\frac{1}{30000}$
6.	Trinidad bay	$\frac{1}{20000}$

No. 7. Mouth of Columbia river—second edition 1/40000
8. Davis' South shoal—fifth edition 1/200000
9. Beaufort harbor 1/20000
10. Frying-Pan shoals 1/120000
11. North Edisto river 1/50000
12. Entrance to Savannah river 1/30000
13. Western coast of Florida 1/1200000
14. Savannah city, Front and Back rivers 1/20000
15. Mobile bay 1/200000
16. Delta of the Mississippi 1/60000
17. Galveston bay 1/200000
18. Key West 1/100000
19. Buttermilk channel, New York harbor 1/5000
20. Entrance to Chesapeake bay 1/100000
21. Fishing or Donoho's Battery (Chesapeake bay) 1/80000
22. Hatteras shoals 1/20000
23. Hatteras inlet 1/120000
24. Bull's bay 1/40000
25. St. Andrew's shoal 1/60000
26. Mosquito inlet 1/40000
27. Cape Canaveral 1/60000
28. Rebecca shoals 1/600000
29. Reconnaissance vicinity of Cedar Keys 1/300000
30. Horn Island Pass, Grand bay 1/300000
31. Pass Christian 1/40000
32. Aransas Pass 1/30000
33. Mare Island straits 1/30000
34. Point Conception 1/40000
35. Point Pinos 1/20000
36. Changes in Sandy Hook 1/10000, 1/40000
37. New river and bar 1/15000
38. Channel No. 4, Cedar Keys 1/30000
39. St. Marks bar and channel 1/40000
40. Catalina harbor 1/15000
41. Monterey harbor 1/40000
42. Prisoners' harbor, Cuyler's harbor, and northwest anchorage San Clemente island 1/20000
43. San Pedro 1/20000
44. Point Conception, and Coxo, Santa Cruz, San Simeon, and San Luis Obispo 1/20000, 1/40000
45. San Francisco city 1/10000
46–51. Cat Island tidal diagram, 1852.
52. Current chart of Boston harbor 1/100000
53. San Francisco bay entrance 1/400000
54. Cape Hancock 1/20000
55. Beacon ranges, New York harbor 1/40000
56–79. Sketches of the progress of the survey in the several sections, and in particular localities. Magnetic diagrams. Diagram of deep-sea soundings in Sections II, III, and IV, &c.

3. List of maps engraving.

No. 1.	Salem harbor	$\frac{1}{25000}$
2.	Boston harbor	$\frac{1}{40000}$
3.	Wellfleet harbor	$\frac{1}{50000}$
4.	Muskeget channel	$\frac{1}{60000}$
5.	Eastern series No. 1, from Block island eastward	$\frac{1}{80000}$
6.	Long Island sound, Sheet No. 1	$\frac{1}{80000}$
7.	Long Island sound, do No. 2	$\frac{1}{80000}$
8.	Long Island sound, do No. 3	$\frac{1}{80000}$
9.	Mouth of Connecticut river	$\frac{1}{20000}$
10.	South side Long Island, Sheet No. 2	$\frac{1}{80000}$
11.	South side Long Island, do No. 3	$\frac{1}{80000}$
12.	Seacoast of Delaware and Maryland	$\frac{1}{200000}$
13.	Chesapeake bay, Sheet No. 1	$\frac{1}{80000}$
14.	Patapsco river	$\frac{1}{60000}$
15.	Cape Fear river and New inlet	$\frac{1}{40000}$
16.	North Edisto river	$\frac{1}{50000}$
17.	Charleston harbor	$\frac{1}{30000}$
18.	Mobile bay, Sheet No. 1	$\frac{1}{80000}$
19.	Mobile bay, do No. 2	$\frac{1}{80000}$
20.	Galveston entrance	$\frac{1}{40000}$

APPENDIX No. 7.

List of information furnished by Coast Survey, in reply to calls, under authority of the Treasury Department.

No. 1. Map of San Francisco entrance.
2. Charleston harbor.
3. Buzzard's bay.
4. San Diego entrance.
5. San Francisco entrance. (2d copy.)
6. Copy and tracing of Mare Island straits.
7. Tracing of Mahon river.
8. Tracing of Cecil county, Maryland.
9. Tracing of Delaware river, in front of Philadelphia.
10. Tracing of East river.
11. Tracing of East river.
12. Tracing of sections of East river.
13. Tracing of Annemessic river.
14. Tracing of Delaware river, below navy-yard.
15. Tracing of Appomattox river.
16. Tracing of Magothy river.
17. Tracing of Dorchester and Roxbury.
18. Tracing of Hemger's creek.
19. Tracing of Mahon and Dona rivers.
20. Tracing of Thirdhaven creek.

No. 21. (Two.) Tracing of Western Coast reconnaissance from San Diego to San Francisco.
22. Tracing of New river and bar.
23. Tracing of Steuben, Maine.
24. Tracing of survey of St. Marks.
25. Tracing of Delaware river, in front of Philadelphia.
26. Tracing of Delaware river, in front of Philadelphia.
27. Tracing of Santa Cruz islands.
28. Tracing of Cambridge and Beverly.
29. Tracing of Absecum inlet.
30. Tracing of Delaware river and Camden.
31. Tracing of Annemessic river.
32. Tracing of Absecum inlet.
33. Tracing of Delaware river from canal to Gloucester Point.
34. Tracing of Charleston bar, S. C.
35. Tracing of bar and channel of St. Marks.
36. Tracing of Absecum shoals.
37. Tracing of Patapsco river.
38. Tracing of Delta of the Mississippi.
39. Tracing of Patapsco river.

APPENDIX No. 8.

Report of Lieut. Washington A. Bartlett, U. S. Navy, assistant in Coast Survey, to the Superintendent, on the examination of Pot Rock, Hell Gate channel, New York.

WASHINGTON, *March* 20, 1852.

DEAR SIR: I have the honor to submit for your information a sheet which exhibits the result of my last examination of Pot Rock, in Hell Gate channel, New York, made on the 15th instant, by which you will perceive that the depth at *mean low water* is 20½ feet on the shoalest part of the rock.

Since the 1st of January last the area of Pot Rock has been reduced from 225 feet in length (at 24 feet depth) to 172 feet, and in width from 60 feet to 40 feet.

At the same date the extent of the 20 feet curve (including the 19½ feet spots) was 96 feet in length by 30 feet in width, which had all been deepened to the depth of 20½ feet at the shoalest part, when measured by the plane of *mean low water*.

M. Maillefert is now engaged in reducing the "Frying-Pan" and "Way's reef," and will soon be able to report increased depth of water on each of these hidden dangers.

I have also prepared a diagram showing the action of the water at Pot Rock during flood and ebb tides, both before and since the deepening of the water on Pot Rock.

The great value of this improvement in the eastern entrance to New York harbor can scarcely be over-estimated, and it is to be hoped that M. Maillefert will receive such aid from the general government as will enable him to prosecute the work till all the sunken rocks of the "East river" are placed below the depths required for purposes of navigation.

Very respectfully, sir, I have the honor to be your obedient servant,

WASHINGTON A. BARTLETT,
Lieut. U. S. Navy, Assist. U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 9.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, asking authority to publish the results of the recent survey of Pot Rock, at Hell Gate, New York.

COAST SURVEY OFFICE,
January 27, 1853.

SIR: Having reported, as the result of a survey of Pot Rock, at Hell Gate, New York, after the blasting there, that the rock had been reduced from eight feet mean low water to twenty and a half feet, I have now the honor to state that a subsequent survey by Major Fraser, of the Corps of Engineers, in charge of the removal of the rocks in Hell Gate, under the appropriation contained in a bill approved August 1, 1852, showed but eighteen feet on this rock, and that one made recently, and after additional blasting, gives a depth at three points of less than twenty feet, and the present least depth at mean low water on the rock a little over nineteen feet. According to Major Fraser there is probably now but a very small part of the rock higher than the plane of twenty feet reference.

I would respectfully request authority to publish this statement.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Hon. THOS. CORWIN,
Secretary of the Treasury.

APPENDIX No. 10.

Extracts from the Report of Lieut. Comg. John Rodgers, U. S. Navy, Assistant in Coast Survey, to the Superintendent, on the discovery of a shoal near the Rebecca shoal, Florida coast.

U. S. COAST SURVEY STEAMER LEGARÉ,
Key West, June 15, 1852.

DEAR SIR: I have received your telegraphic despatch in relation to the currents in the harbor. I have commenced the observations.

I propose, should it meet your approbation, to leave here for Baltimore about the first of July.

Our work at the Tortugas has not turned out quite satisfactorily.

We found a shoal near the Rebecca with 15 feet water on it; its position is only an approximation, since angles could be taken so far from the light-house alone.

Its distance from the Rebecca shoal was estimated from several careful runs by log and compass. Had it been anticipated that we could not be seen from both theodolite stations, I should have used different means.

The weather was generally unfavorable, squally and misty.

We measured a base line on Loggerhead key; took angles to the light-house and theodolite tower on North key; used North key and light-house as stations for theodolites; ran the Legaré to Rebecca shoal, anchored, and made signal, after she was still, for rounds of angles; let go three water-casks as buoys, around the shoal, from the vessel, with her positions thus determined. These buoys were the basis of boat-work over the Rebecca shoal. Nearly all the work except this boat-work will be lost. The soundings from the boats were minute; least water 7 feet, reduced to low tide.

I made a careful examination of the bottom of the Rebecca shoal, with an iron-shod staff. It is coral rock, with coarse coral sand. I will forward by mail a copy of the work.

I had proposed to return to the Tortugas and get the position of the new shoal more satisfactorily. Three days of good weather would, I think, have been enough. The currents here are so various and intricate, that they will require extensive observations, and I do not think that I shall have time to spare from them.

* * * * * * * * * *

Very respectfully, your obedient servant,

JOHN RODGERS,
Lieut. Comg. and Assist. Coast Survey.

A. D. BACHE, LL. D., *Superintendent.*

APPENDIX No. 11.

Extracts from the Report of Lieut. Comg. John Rodgers, U. S. Navy, assistant in Coast Survey, to the Superintendent, on the discovery of Legaré harbor of refuge, under Triumph reef, Florida.

U. S. STEAMER LEGARÉ,
Key West, May 28, 1852.

DEAR SIR: We finished Key Biscayne chart at 12 o'clock Saturday, May 15. We arrived here next day out of repair, and with the crew scorbutic—some of them sick. The scurvy I attribute partly to hard work, but principally to sea diet.

The chart extends from Narrows Cut to Elliot Key No. 1. This last position is about six and a half miles below the southernmost plane-table work; it therefore seems desirable to have the required plane-table work finished as soon next season as possible, since the chart cannot be published before it is done.

We discovered a harbor of refuge under Triumph reef. It has as good natural marks as the keys can give; but, unfortunately, the keys are so much alike that the stranger cannot distinguish them; and until he can assure himself of the identity of any mentioned key, the direction how to use it cannot avail him. To make, under such circumstances, any harbor available to commerce, artificial means must be used to point it out.

The harbor is easy of access, near the Gulf Stream, and may be used without a pilot, but it needs buoys to define its place.

To vessels in distress, or baffled by strong currents and light winds, it would be useful.

Too much importance cannot be attributed to any helps to commerce through the Gulf.

The vast trade which passes through this channel, and the difficulties of its navigation and the number of its wrecks, need no mention.

I enclose a tracing of the harbor, which I have ventured to call after the steamer. The reefs are called after the vessels which are wrecked on them; there seems a propriety in calling harbors after the vessels which discover them.

* * * * * * * * * *

Very respectfully, your obedient servant,

JOHN RODGERS,
Lieut. Comg. U. S. Navy, and Assist. Coast Survey.

A. D. BACHE, LL. D.,
Superintendent Coast Survey.

APPENDIX No. 12.

Extracts from the Report of Assistant F. H. Gerdes, to the Superintendent, of a reconnaissance from the Suwanee river, Florida, to the mouths of the Mississippi, Louisiana.

STATEN ISLAND, NEW YORK,
July 31, 1852.

GENERAL REMARKS on harbors, rivers, streams, shoals, the navigation, tides, currents, light-houses, beacons, &c., on the north coast of the Mexican Gulf, *from Cape Florida to the Delta of the Mississippi*, accompanied by propositions for the execution of the survey of the coast.

SIR: In a former report I have endeavored to describe the character of the coast of the Peninsula of Florida, from Cape Florida to the Suwanee river, and I have remarked on the facilities and the difficulties of continuing the adopted system of triangulation as a basis for the operations of the Coast Survey. Over the bays and harbors within the said limits I have proposed a net-work of triangles, grounded upon a short and general reconnaissance, and sometimes upon a more detailed investigation. By a closer search, without doubt, many and great improvements to my plans may be found; but I have reason to believe that, on the whole, the sketch accompanying my report will be the foundation for the execution of the Coast Survey.

Since 1851, I have continued these investigations to the north and west of the Suwanee river, and, with the exception of certain districts, I have visited the whole western coast of Florida, which gives, with the former reconnaissances, a nearly uninterrupted distance of six hundred miles in a straight line, or more than one thousand miles by following the curves of the coast, viz: from Cape Florida, on Key Biscayne, to the mouth of the Mississippi. The following remarks, with the exception of those alluding to the unexplored parts, are, therefore, chiefly grounded upon personal investigations.

The coast on the north of the Mexican Gulf possesses numerous bays and harbors, several of them by far superior to those on both sides of the peninsula. The most superior facilities for navigation exist probably in one of the same—St. Andrews' bay—which is least known and least frequented, either as a commercial port or as a harbor of refuge. As a general fact, however, it may be asserted that more business is done and more intercourse with foreign and home ports carried on in the northern harbors of Florida, than in those of the peninsula. The navigation is not dangerous: in many places it is even easy, were the localities only known; but the geographical, topographical, and hydrographical determinations are in certain places so exceedingly erroneous, that frequently the navigator has to trust to chance and partly guess his way. For a better explanation, I add to these remarks a sketch of reconnaissance, commencing at the Suwanee river and extending to the Delta of the Mississippi, being on the same scale and a continuation of the Sketch F, accompanying your report of 1851. The scale of this sketch being very small, I have prepared, of the two portions that were investigated more in detail, separate diagrams—the one of St. George's sound, and the other of the Chandeleur bay—both containing the proposed triangulation.

I. COAST ON THE GULF OF MEXICO.

(a.)—Suwanee River.

The Suwanee river, emptying into the Gult about ten miles to the north of the Cedar Keys, is a stream of considerable importance. The upper part is well settled; cotton, sugar, and tobacco are plentifully raised; and the river is navigable, and forms a regular steamboat

route, by which the produce is chiefly forwarded to the warehouses on Cedar Keys for further transportation to New York. A bar obstructs the navigation at the mouth of the river, and forms a great impediment to the more rapid growth of the settlements.

(b.)—Coast between the Suwanee River and St. Marks River.

From the Suwanee towards St. Marks the coast forms a semicircle to the NW., at a distance of about ninety miles. The shoals extend considerably from the shore, and prevented me from any attempt to land. This portion I have therefore not visited, but some information was received from very respectable sources. Between the two rivers flow about eight streams and a few insignificant bayous, all running through low and marshy outlets into the Gulf, but possessing more or less fine and fertile hammock land on their borders. The following are their names, beginning north of the Suwanee:

1. Name unknown, about 20 miles from the Suwanee.
2. Esteen-hatchee, the mouth of which is called Deadman's bay, about 35 miles from Suwanee.
3. Creek, name unknown, about 45 miles.
4. Creek, name unknown, about 50 miles.
5. Ocillotafuika, about 60 miles.
6. Fenahallawa, about 70 miles.
7. Enoonfenee river, with some small islands at the mouth, named Rocky islands, about 78 miles.
8. Ocilla, about 85 miles.
9. St. Marks river, about 90 miles.

The whole coast appears from sea very low and monotonous, and only vessels of very light draught can approach so near in clear weather as to distinguish the same plainly and minutely. The shoals, I should judge, extend in some parts 15 or 18 miles from shore.

(c.)—St. Marks.

A special and full reconnaissance was made of the river, harbor, and offing of St. Marks, in April, 1852, by your direction. I refer, therefore, with regard to it, to my report dated Mobile, 1852.

(d.)—From St. Marks to the Southwest Cape.

The river St. Marks is situated on the most northerly point in this semicircle, in the Gulf, and from here the shore curves again to the SW. towards the eastern cape of St. George's sound, properly named the "Southwest Cape." The distance is about 20 miles, and the coast very broken, forming the "Shallow bay" and the "Oklokonee bay." Southwest cape is a headland, in some places a little elevated and everywhere thickly wooded, and very prominent in appearance on account of a fine white sandy beach, which might be distinguished far out at sea.

Capt. O. A. Pittfield, of the U. S. Florida mail steamer "James L. Day," had offered me all possible facilities for a short investigation of the inlets in St. George's sound and of the shoals of the Southwest cape, &c., and in consequence of such kind attention I embarked on board of his vessel and sent my schooner, in charge of my aid and of the mate, direct to Mobile. Let me mention here the obligations under which Captain Pittfield has placed me and the Survey, and express my thanks for his unwearied attention, for the loan of his boats and crew for frequent stoppages on my account, for his assistance in obtaining information, and for many services rendered with a good will and a highly commendable spirit for the

advance and facilitation of such a national work as our Coast Survey. I left St. Marks through the "Spanish Hole," and we followed the west bank close to the edge. Off Shell Point, about ten miles west of St. Marks, the water appeared to deepen: abreast of Shallow bay, however, we had to stand out again, at least to a distance of ten miles from the shore. When due east of the Southwest cape we anchored, and I went in a boat to the *Oklokonee shoals*. They are situated nearly six miles from the Cape, bearing from it ESE., and have, on two spots, only three and five feet of water, with very heavy breakers. An excellent and smooth passage lies between this shoal and the coast, course nearly north and south, distance about four miles from shore, and least water eleven and twelve feet. From here I went to the *South shoals*, distinguished even in the calmest weather by heavy breakers; they lay at a distance of about eight miles, bearing S. by E. from the Cape, and have also, on some spots, only three feet of water. Inside of these shoals, as I was told by the chief pilot of Appalachicola, six or seven feet may be carried through a swash channel—very crooked, however, little known, and consequently not made use of. It is the opinion of seafaring men, that if the Oklokonee and South shoals were well determined on charts, and marked by either beacons or large buoys, the trade and communication between St. Marks and Appalachicola would be carried on between the two shoals through this passage. This is corroborated by my own observations—the more, as I am inclined to believe that the Oklokonee shoals extend far to the eastward, either as a large flat or in single lumps. My aid, Mr. Oltmanns, reported to me that at the time I was in the steamer he laid his course, with the schooner Gerdes, S. by W. from St. Marks, and that, when at a distance of fifteen or twenty miles, the lead gave gradually only eight feet, so that he had to alter his course to S. by E. This curve of the Gulf, enclosed by the shores from the Southwest capes to the Esteenhatchee and Deadman's bay, is generally called the Bay of Appalachee.

(e.)—St. George's Sound.

St. George's sound is formed by the main coast of Florida, extending nearly from the Southwest cape to Cape St. Blas, and by three more islands, viz: Dog island, St. George's island, and St. Vincent's island. The course of this sound is NW. by W., and SE. by E., extending about forty-five miles, with a breadth of six or eight miles. The sound has four entrances, two of which have sufficient water for the admission of ships, with fine anchorages, and a tolerable navigation for lighter and smaller craft in the sound. On the eastern termination the shore of the sound is formed by the Southwest cape, (which, properly speaking, is also part of an island called St. James') and is low, swampy, and thickly wooded. This character extends to the Buckhead Point, sometimes called the East Point, with the single exception of Point Gadsden, where the land is more elevated. The highest spot there is named Mount Lookout. From Buckhead Point the coast is broken and marshy, and only thinly wooded, and bears the usual character formed by outlets of large rivers, which is here produced by the Appalachicola river, emptying into the St. George's sound.

The city of *Appalachicola* is situated west of the mouth of the river, on a point of low land between Lake Wimico and the sound. The city has about 1,500 inhabitants, a large number of storehouses and cotton presses, and considerable commercial business is here transacted. The place was much injured in the hurricane of August 24, 1851, and many houses and much other property were destroyed. In the present season the cotton export is estimated at 170,000 bales, which, in this commercial branch, gives to the port the fourth rank among the harbors in the United States.

Dog island is a small wooded island, stretching along the coast nearest the Southwest cape; it is about six miles long and one mile wide. The next is *St. George's island*, being

situated abreast of Appalachicola; it extends twenty-five miles in length, and is from a half to one mile wide, and altogether covered with wood. Three miles from the western terminus it forms an obtuse angle and point, bearing the name of Cape St. George. *St. Vincent's island* is the last one, and closes the sound to the westward; it is eight miles by three in extent, and everywhere thickly wooded.

The *eastern entrance* into St. George's sound is close to the east point of Dog island. I have not been through this passage myself, but do not believe that much water can be carried over the bar. According to the charts of Messrs. Blunt, 1844 and 1851, there appear to be three fathoms of water; but this cannot be the case; or if it was formerly so, the channel must have changed much. The *middle entrance* is between the two points of Dog island and St. George's island, and easily distinguished by breakers on both sides, and buoys in the channel. When the outer buoy is visible it is best to run for the same,—pass it close and steer northwest, which will give the deepest water over the bar and through the channel. This passage has fifteen feet of water, and an anchorage inside of the same. The *main entrance* in the sound, sometimes called the west entrance, has twelve and a half feet of water, and lies between St. Vincent's and St. George's islands. If the outer buoy is visible, it has to be passed closely, and the course N. by W. ½ W. must be steered to cross the bar and to run through the channel into a safe anchorage on both sides of the pass. There are two small sand-knolls south of St. Vincent's, called the "Sand Keys," which are bare at low tide, and another one west of the channel, named Flag island, which remain untouched even by ordinary flood-tides. *Indian Pass* is the name of the fourth entrance on the extreme west, between St. Vincent's and the main, but the water is so shoal that only boats are able to cross the opening.

The navigation in the sound itself is much obstructed by a shoal called the Bulkhead bar, running across from the east point on the main shore to St. George's island. On the most favorable spot only six feet water can be carried over the same. This is, however, also the largest draught which can be carried up to the wharves of Appalachicola.

(f.)—Cape St. Blas.

About 25 miles westward of Appalachicola, the coast of Florida forms a rectangular point, which is called Cape St. Blas. At this corner the coast, coming from the east, turns abruptly to the north, and by degrees curves gently to the NW. and W. St. Blas is no headland; it is in fact only the turn of a woody sea-beach, forming the enclosure of St. Joseph's bay. A dangerous reef extends south from the cape, and breakers may be seen sometimes six miles from the point. To the east of these breakers there is, however, a safe anchorage in all northerly winds.

(g.)—*St. Joseph's Bay.*

The formerly flourishing little town of St. Joseph's takes its name from this most beautiful bay. This sheet of water extends from Cape St. Blas nearly sixteen miles to the northward, and is from six to ten miles in breadth. The bay is separated from the Gulf by a narrow beach, and looks like an artificial harbor on an enormous scale. A vessel bound for the entrance may run anywhere for the beach, and steer a parallel course within two miles of the same, until the point of the beach bears E. by S., when the harbor may be entered with a due E. course, and twenty-four feet of water will be found. No bar, nor anything else, obstructs the wide opening: a small sand-flat only extends for one mile westward from the coast; but even on this, sixteen feet of water is usually found. There used to be a railroad from the town of St. Joseph's to some point on the Appala-

chicola river, and surveys and plans for canals, and other roads, were in contemplation; but all has been abandoned—in fact, numerous houses and dwellings in the town stand uninhabited, and this fine sheet of water is only used, in a case of danger, as a place of refuge. I know of no harbor affording more easy access, better anchorage, and greater advantages for entering in a gale, and even a hurricane.

(*h.*)—*St. Andrew's Bay.*

The inlets into the bay of St. Andrew's begin about twelve miles above the point of St. Joseph's. I have not been in the bay myself, but I was informed that this is the best harbor in all Florida, and that the entrance is even superior to Pensacola; and it is asserted by Captain O. A. Pittfield, of the mail-steamer James L. Day, that thirty-two feet of water can be brought over the bar. The bay has three or four inlets, little if at all frequented, and the only trade is in lumber and timber.

(*i.*)—*Choctawhatchee Bay.*

The coast from St. Andrew's to the inlet of the Choctawhatchee, or Santa Rosa bay, is monotonous, low, sandy, and chiefly covered with pine, and only varying in appearance in small spots, with few sand-hills, and two or three red clay bluffs. The inlet in the bay is on the east of Santa Rosa island, and is said to have only four feet of water on the bar. The bay extends from here for nearly thirty miles to the east, and is generally from five to ten miles wide. This fine sheet of water is separated from the Gulf by a neck of land, in some places three, and in others ten miles in breadth. A small trade, chiefly in lumber and timber, constitutes the only business. The bay is famous for the quantity and quality of its fish.

(*k.*)—*Pensacola Bay, &c.*

Santa Rosa island, Santa Rosa sound, Perdido and Pensacola bays, with the coast, were reconnoitred in 1848. I refer, therefore, to my report of that date.

(*l.*)—*Mobile Bay—Mississippi Sound—Lakes.*

The bay and harbor of Mobile, the Mississippi sound, with the islands and coast, and the New Orleans lakes, were reconnoitred in 1844 and 1845, and have been since surveyed. I refer to my report of reconnaissance.

(*m.*)—*Chandeleur Bay, Louisiana.*

In May, and afterwards in June, 1852, I sailed for the Chandeleur islands, and came to anchor under the north point, (Naso Roads.) The weather was rather thick, and the sights obtained were imperfect. I saw and visited the Samphire keys, St. Miguel keys, and other groups and patches. I went also to the marshy points of the main of Louisiana, to the west and southwest of the Chandeleur light-house. Most of the islands are low and marshy, and their only growth consists of myrtle bushes; the position of many of them could not be well ascertained, and existing charts do not throw a clear light upon their number, groups, and localities.

The space between the Chandeleurs and the western main coast, I believe, is hardly so wide as represented on the charts of Messrs. E. & G. W. Blunt, 1844 and 1851. The north point of the North Chandeleur island, now containing a light-house, is located at

least about five miles more to the west, and three miles further to the north, than the map represents it; and as the Gulf coast of these islands runs more or less north and south, I suppose that the whole line requires the same (at least the longitudinal) correction. If so, such correction will prove a very great advantage to the survey of the coast.

Between the islands Grand Gosier and Isle au Breton and the main coast of Louisiana, no sights whatever could be obtained across; but it must be considered that the coast, as well as the islands, is exceedingly low, and almost without any trees and bushes. However, it may not be impossible to get lines across under more favorable circumstances, and with the aid of artificial elevations on both sides; but it is certain that this will require first a most minute and special reconnaissance.

II.—Methods for the Survey.

For several years I have been frequently intrusted by you with important reconnaissances for the execution of the survey of the coast; and I have been so fortunate as to secure your approval of the plans which I recommended for adoption, without any exception. I am fully conscious of the great importance which you attach to the uninterrupted continuation of our beautiful system of triangulation, chaining together the coast of the Union from section to section, by links of unerring accuracy. It has always been my desire to deviate as little as possible from this system; although it has been sometimes unavoidable to add either to the regular operations certain measures, or to substitute others, according to the locality of the country in question. From the general rule of triangulation, however, no deviation has ever been made on the Gulf; and I think and trust that the whole coast, spoken of in this report, will afford facilities to carry out the same system, not excepting, however, the restrictions, additions, and substitutes alluded to above. Under the additions to the usual *modus operandi* I include a greater number of verifications, such as astronomical stations, bases, &c.; under the substitutes I would class artificial signals on shoals, observations off shore, on board vessels, &c.; and under restrictions, measurements of lines instead of triangles.

By looking at the accompanying sketch-map, you will agree with me at once that the northern coast on the Gulf seems to be sufficiently broken and irregular to facilitate a system of triangulation. More or less difficulty will be found, such as I have already experienced during my short search, in many parts of this coast, and these difficulties will increase as the investigation becomes more detailed; but with a careful perseverance, means can and must be found to overcome all obstacles.

The coast from the Suwanee river upwards to St. Marks I have not visited personally, and shall, therefore, refrain from all remarks respecting triangulation. It may be as well to mention here that this will be the case with all the other portions on the coast which I did not see: those are delineated only in outline on the maps.

With the aid of one water station on the west bank off St. Marks, a series of triangles can be constructed from thence to the bay of Oklokonee, but there the continuation becomes more difficult. The shoals of Oklokonee and Southwest cape afford localities for water stations, by means of which the cape may be doubled; but it will require one more such, and at present I am not prepared to point out its position. By courtesy I was restricted, in a manner, to the movements of the steamer J. L. Day, and at this place, particularly, I could not well require a longer delay, as the weather looked severe and threatening. St. George's sound can be triangulated with ease by a regular chain of triangles. but some difficulty may arise between St. Vincent's and St. Blas. We were

anchored inside the islands, and the wind was too strong to cross the bar in a row-boat; I cannot, therefore, judge with any certainty, except from what I saw the next day, when we got under way and passed out with the steamer. I believe that a station on Flag island might be established, and without much difficulty be connected with Appalachicola and Indian Pass, and that the southern extremity of Cape St. Blas might be taken again from Indian Pass and Flag island. St. Joseph's bay itself is open, and no obstruction whatever to be found for triangles; a connexion with those east of St. Blas will require more or less cutting of trees. St. Andrew's bay has to be connected with the series from St. Andrew's Point, if it can be done at all. Sailing along the coast, I have noticed openings in the woody beaches, and I am inclined to think triangles may be established inland. Should this not be the case, the station at St. Andrew's Point can be at all events included in the St. Joseph's and St. Andrew's bay triangulations. The bays of St. Andrew's and Choctawhatchee are not yet reconnoitred; a plan for Pensacola, Santa Rosa sound, and Perdido bay, I reported in 1848; and in Mobile bay and the Mississippi sound the triangulation is nearly finished. In the Chandeleur bay the base for extending the primary series has to be derived from the triangle—Chandeleur, North Cat island, Ship island; and from such base a net-work may be established to the lower end of the South Chandeleur, and to the second point on the main coast of Louisiana, above the Raccoon islands.

The following primary triangles are practicable:

1. IN FLORIDA.

1. Fort St. Mark's. St. Mark's Point, east. West entrance, 2.	2. West bank. St. Mark's Point, east. West entrance, 2.	3. Live-oak Point. West entrance, 2. West bank.
4. Shell Point. Live-oak Point. West entrance, 2.	5. Shell Point. Live-oak Point. West bank.	6. Shell Point. Oklokonee Point, south.
7. Oklokonee Shoal. Southwest Cape. Oklokonee Point, south.	8. Dog Island, east. Oklokonee Shoal. Southwest Cape.	9. South Shoal. Southwest Cape. Dog Island, east.
10. St. James' Island. Southwest Cape. Dog Island, east.	11. Dog Island, east. Gadsden's Point. St. George's Island, east.	12. Mt. Lookout. Gadsden's Point. St. George's Island, east.
13. St. George's Island, 2. St. George's Island, east. Mt. Lookout.	14. Bulkhead Point. St. George's Island, 2. Mt. Lookout.	15. St. George's Island, 3. St. George's Island, 2. Bulkhead Point.
16. Appalachicola. Bulkhead Point. St. George's Island, 3.	17. St. George's Island, west. St. George's Island, 3. Appalachicola.	18. Green Point. St. George's Island, west. Appalachicola?

IN FLORIDA—Continued.

19. Indian Pass. Green Point. St. George's Island, west.	20. Cape St. Blas. Indian Pass.	21. St. Joseph's Beach, 1. St. Joseph's Main, 1. St. Joseph's Main, 2.
22. St. Joseph's Beach, 2. St. Joseph's Main, 1. St. Joseph's Beach, 1.	23. St. Joseph's City. St. Joseph's Beach, 2. St. Joseph's Main, 2.	24. St. Joseph's Point. St. Joseph's Beach, 2. St. Joseph's City.
25. St. Joseph's Main, 3. St. Joseph's Point. St. Joseph's City.	26. St. Andrew's Point. St. Joseph's Point. St. Joseph's Main, 3.	

2. IN LOUISIANA.

(N. B.—The designation of stations by numbers, is here and elsewhere, of course, only preliminary. The proper names could not be ascertained at the time.)

27. Chandeleur, north. Cat Island Main. Ship Island Main.	28. Samphire Island, east. Cat Island. Chandeleur, north.	29. Long Point. Cat Island. Samphire Island, east.
30. Long Point. Chandeleur, north. Cat Island.	31. Long Point. Samphire Island, east. Chandeleur, north.	32. Chandeleur, centre. Samphire Island, east. Chandeleur, north.
33. Island No. 3. Samphire Island, east. Chandeleur, middle.	34. Station No. 1. Samphire Island, east. Station No. 3.	35. Station No. 3. Station No. 4. Station No. 5.
36. Chandeleur, south. Station No. 3. Chandeleur, centre.		

The following lines are practicable:

1. Chandeleur, south, to Grand Gosier.
   Station No. 3 to Station No. 4.
   Station No. 4 to Station No. 5.
   Station No. 5 to Battledore Island.
   Battledore Island to Isle au Breton.

Besides several shorter lines between Isle au Breton and the Grand Gosier.

* * * * * *

Respectfully submitted to your consideration.

F. H. GERDES, *Assist. U. S. Coast Survey.*

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 13.

Extracts from the report of Assistant F. H. Gerdes to the Superintendent, of a reconnaissance of the bar, river, and harbor of St. Marks, Florida.

MOBILE, *April* 26, 1852.

SIR: In conformity with your orders, I have made a reconnaissance of the bar, outer and inner harbor, the river, and adjacent country of St. Marks, Florida.

As this work was of a detailed nature, the means employed to execute it were more carefully selected than in large and general reconnaissances, and consequently a greater accuracy was obtained. Latitudes at Fort St. Marks, and at the St. Marks light-house, and an azimuth between these two places, were received from the observations of J. E. Hilgard, Esq.; and a longitude was *pro tem.* adopted from the difference in time between it and Cedar Keys by my chronometer. The result, though disagreeing with Mr. Blunt's chart by nearly ten minutes, compares well (within thirty seconds) with observations made several years ago by Lieut. Semmes, U. S. Navy. I have also some reason to believe that the results obtained for difference in longitude from twelve chronometers by Mr. Hilgard coincide with mine, although the final computations were not made at the time of his leaving.

A base, upon which the reconnaissance was grounded, was derived from the two latitude stations and their azimuth, which courses nearly north and south. Two additional lines, situated at right-angles between the two latitude stations, were carefully measured for verification, and the angles with the light-house and fort measured with a theodolite. With the same instrument a secondary triangulation from the latitude stations was made, and from it all the buoys and visible objects were determined. The shore-lines were taken by compass bearings, and from triangulation by a multitude of stations along the river. The soundings in the Spanish Hole and on the bar were derived chiefly from ranges; and all the points of sounding lines determined by sextant angles, the soundings themselves being taken by time. Tidal observations were made during the operations, and all the numbers reduced to actual low water; the average rise and fall of tide amounting to two feet eight inches.

On the bar of St. Marks, and in the Spanish Hole, the state of the water was minutely ascertained by a large number of soundings, which, from their uniformity, were reduced to a limited number, which you will find recorded in the accompanying chart. In the river St. Marks it was, however, impracticable to make a complete survey of the depth, as this would have consumed at least several weeks. I took one line of soundings three times through the middle of the very narrow and crooked channel, as pointed out to me by the branch pilots of the place, and verified the position of each cast by bearings on stations and determined objects on shore. The result of the soundings is, that eleven feet may be brought into the Spanish Hole over the outer bar, and six and a half feet up to the railroad depot at St. Marks. The anchorage inside of the bar is good, and has blue and soft mud for holding-ground. The soundings, of course, refer to low water, as I found it during the survey. Not unfrequently, however, the tide rises here considerably—a natural consequence of the shape of the bay of Appalachee, which forms between the South cape and the Cedar Keys a kind of bag; and in such cases, which arise invariably with southerly winds, usually three or four feet is added at high water. If winds, however, blow for any length of time from a northerly direction, (and this is in winter and spring quite frequently the case,) the water falls likewise uncommonly low, and the river is then only navigable for very small craft.

In all northerly winds there is a very good anchorage outside the bar in the bay of Appalachee: the best holding-ground of sticky mud I found to the westward of the buoys.

At the mouth of the river, on the east side at St. Marks Point, is the light-house, with fifteen lamps, which are elevated seventy feet. It shows very faintly, and is considered by seamen insufficient. Captain Pittfield, of the Florida mail steamship J. L. Day, had come to anchor, not being able to see the light in a tolerably clear night, and found himself next morning within five miles of it. A stone wall surrounds the tower, but in the last gale and great inundation (August 23, 1851,) one hundred and sixty feet of this wall, ten feet high, and six by two feet section, were washed down by the force of the sea, and have not been rebuilt. As, of late, hurricanes and gales have been more frequent on this coast, (1843, 1850, 1851,) and have done terrible damage, and as it appears not unlikely that similar storms may prevail again this season, I am thoroughly convinced that the light-house cannot again withstand such a force, and will give way if the wall should not have been rebuilt previously. The shores of St. Marks river and of the coast near its mouth are very low, and cannot check a high tide. On the stream, for a distance of two or three miles, they are open, low and marshy; in some places the soil is more compact, being intermixed with sand. Two miles below the depot at St. Marks was a flourishing town, called Port Leon, but the whole was swept away in 1843, and nothing now remains from nearly two hundred houses, but the skeletons of two old buildings. A railroad connected this place with St. Marks: from the same cause, however, it has disappeared, and the embankment of the road is hardly visible. About half a mile below St. Marks, at the junction of the Wakulla and St. Marks rivers, on Holt's Point, stood an old and very strong fort, built a hundred years ago by the Spaniards. The gale of August, 1851, broke it down, and the buildings, solid stone walls, magazines, and store-rooms, form a heap of ruins. It is hoped by the inhabitants that government will allow the use of the remaining granite ruins, hardly worth anything for any other purpose, for the erection of a breakwater, to protect the place in similar emergencies.

The town of St. Marks itself used to be a flourishing little place of some thirty or forty houses, with a railroad to Tallahassee, the capital of Florida, and a branch to Port Leon, both connected with a bridge over the St. Marks river. This last road was destroyed in 1843, but the main track to Tallahassee is still in use, and a train drawn by horses arrives and leaves daily. There are several large storehouses and a cotton press, and considerable business is transacted here. In 1851 some 40,000, and in 1852 about 35,000 bales of cotton were shipped at this port.

St. Marks has suffered much in late years, and in the last hurricane, so very destructive all along the coast to the westward, all the habitations, excepting only four or five, were levelled with the ground.

About three miles above St. Marks (five by the river) is Newport, a flourishing town, of considerable size and some mercantile importance.

* * * * * * * * * * *

A regular triangulation may be effected very easily over the river valley of St. Marks; but I am not prepared to say how this may be carried eastward towards the Suwanee river. A scheme for connexion westward towards St. George's sound, you will find proposed in a report and sketch of a general reconnaissance of the western coast, which I made directly after my occupation at St. Marks had ceased.

Messrs. Ginder and Oltmanns assisted me during my stay in Florida, very efficiently. The inhabitants of Western Florida, from Tallahassee, Appalachicola, &c., showed much

kindness to me, and seemed to be highly interested and pleased that our survey had been commenced in their waters.

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Respectfully submitted:

F. H. GERDES.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 14.

Extracts from the report of Lieut. James Totten, U. S. Army, assistant in Coast Survey, to the Superintendent, on the placing of screw-pile signals along the Florida reef.

U. S. SURVEYING SCHOONER PETREL,
Off Elliott's Key, March 31, 1852.

SIR: Your instructions of September 22, 1851, and of several subsequent dates, authorized and directed me to adopt such measures as should insure success in getting a number of screw-piles and signal-poles fixed along the Florida reef, at certain important points connected with the triangulation thereof. Relative to the result of my efforts in this matter, I have now the honor to submit the following report for your information. * * * * * * * The points where the screw-piles are, are generally those where there was found to be the least water at low tide—say from two to four feet. It was found impracticable to work in deeper water than four feet with the apparatus which the limited means allowed the contractor placed at his disposal; and even on the shoalest points nothing could be done save in perfectly quiet weather, and at low water.

During the progress of the work, it was ascertained that the depth of water on Collins' Patches and Tennessee reef was so great as to make it impossible, under the circumstances, to put up the piles there, and consequently that some other method of marking these points must be adopted. As Sombrero Key has been observed upon by Mr. Hilgard, or as it is possible to fix an ordinary tripod and signal-pole on it at any future time, when necessary for the purposes of the Survey, I directed the contractor not to place any screw-piles there at all, there being other points where the piles would do much better service.

The three screw-piles and signal-poles mentioned in the last paragraph as not having been placed on the points designated in the contract, I have had placed on other dangerous points, where they will be equally useful to the survey, and to navigation, as if fixed upon the points originally intended.

There is a thick mass of shoals (coral formation) extending from Cæsar's creek, for a distance of something like seven miles northward, and lying midway between the line of keys and the main Florida reef. These shoals divide the waters inside the reef, here, into two main and well-defined channels—the one on the outside being the deepest, and the one on the inside, along the keys, affording water sufficient for vessels drawing anything less than ten feet. Small vessels may also pick their way through the shoals in various directions, but it is believed there is no distinct and well-marked channel except the two mentioned. As these shoals seemed dangerous, at least to the inside navigation, I thought them of sufficient importance to require a permanent mark, and accordingly placed a screw-pile on their northern extremity.

There is a dangerous shoal, or coral reef, bearing nearly SSW. from Key Vacas, called the "Washerwoman." This shoal lies in mid-channel course, sailing either from or to Key

West, between the Florida reef and the line of the keys. The depth of water on the shoal itself, at low tide, does not exceed two feet, whereas from three to four fathoms may be found all around it. On this shoal, then, I caused a screw-pile to be placed, and it will prove as valuable to navigation as to the purposes of the Survey.

About fifteen or twenty miles from Key West, along the line of the Florida reef, and projecting far out towards the Gulf Stream, lies that portion of the reef known as the American shoals, which is notoriously the most dangerous point of all the reefs to navigation, and has heretofore invariably yielded the richest harvest to the wreckers, and the most fatal results to ship-owners or insurance companies. On this shoal I have also caused a screw-pile, &c., to be placed, knowing that it will answer admirably the ends of the Survey, and hoping that it may also serve to warn vessels of their proximity to danger.

The foregoing remarks will serve to show just where the screw-piles have been placed along the Florida reef, and the reasons which have guided me in placing them where they are. * * * * * * * * * *

The piles are generally sunk in the solid material of the reef, wherever they may chance to be located, from three to five feet. Each pile has a signal-pole of the mangrove wood in it, from thirty to forty feet in vertical height, and on the top of each of these poles is fixed a barrel, which, the better to attract the eye and call attention, is painted black. It does not appear probable that any storm which may arise can break these tough mangrove signal-poles, until they shall, in time, become more or less decayed, for the simple reason that there is but a small surface exposed to the action of the wind and waves; and as to the screw-piles ever being removed by the violence of the storms, as long as the reef itself whereon they are located remains, I must say that such a thing looks to me extremely improbable.

It does not require any more evidence of the advantage these screw-piles and their signal-poles must prove to navigation along this hazardous coast, than any one may discover by sailing along the reef from Cape Florida to Key West in the day-time. What light-houses are at night to the mariner, these signals will prove to him by day, on a small scale; they stand amidst the dangers of the reef, and vessels passing along this coast would generally do well to give them a wide berth. Any vessel, with attentive officers, can scarcely ever be run ashore in the day-time for lack of something to warn them of their approach to danger, at least as long as these signals stand, inasmuch as they are sufficiently distinct and remarkable to rivet attention when discovered, and they may be seen with the naked and unassisted eye at a distance of two or three miles, and with a common spy-glass fully from six to ten. If other evidence were required to show what I state above, I am happy to be able to say that I have received the unqualified assurance of one of the ablest seamen who navigate these waters, that the signals, so far as they go, are decidedly of great utility. I refer to Captain Rollins, of the steamer Isabel, who passes with his vessel along the reef four times every month, and can appreciate, and has in a very candid and gentlemanly manner acknowledged, the aid these signals are to him. * * * * * * * * *

I am, sir, very respectfully, your obedient servant,

JAMES TOTTEN,

First Lieut. 2d Artillery, Assistant U. S. Coast Survey.

APPENDIX No. 15.

Extracts from the report of Assistant S. A. Gilbert, U. S. Coast Survey, to the Superintendent, on the survey of Milneburg harbor, Lake Pontchartrain, Louisiana.

NEW ORLEANS, LA., *June* 17, 1852.

SIR: The following is my report of the survey of Milneburg harbor, in accordance with your instructions:

On the 26th of January, 1852, I anchored my vessel off Milneburg, and proceeded at once to determine the relative positions of such objects along the shores of the lake as would be needful for the hydrography. For that purpose a base of 2,700 feet was measured; the survey embraces an area of about three square miles immediately around the railroad company's wharf.

We found very even soundings throughout, and that the character of the bottom is generally the same in similar depths of water. From the shore to a depth of five and a half or six feet the bottom is very hard, being sand and broken shells; from that outward it gradually becomes softer in its character, and at ten feet is composed of soft blue mud and shells, which affords excellent holding-ground for vessels at anchor.

Around the wharf on each side is a hard sand shoal, which is bare at extreme low tide. The fact of the wharf having been built there, and the close, compact manner in which it was constructed, is the cause of this shoal, by its obstructing the currents which set along the shore at right-angles with the wharf, with a velocity sometimes of two and a half to three miles an hour. When a northwest wind blows after the prevalence of southerly winds, which is frequently the case, the greatest velocity of the ebb tide is attained; and the wharf preventing an obstruction to its course, an eddy is formed on the east side, and the heavy particles borne along by the current are deposited. Such, also, is the case with the west side when the flood-tide rushes in during the prevalence of east and southeast winds.

We also find that there is a small shoal—or rather it seems more like a continuation of that around the wharf—of hard sand, having but four and a half feet water on it between the head of the wharf and the breakwater; this is in part attributable to the breakwater, but mainly to the compact nature of the wharf, and the fact of the wharf jutting out into the crescent formed by the breakwater. The volume of water in making its way around the wharf strikes the extremes of the breakwater and is slightly checked in its course, and during this check the heavier particles are deposited, and hence the shoal.

I do not think that were a harbor constructed here by building a breakwater, it would fill up if the breakwater was placed at a proper distance from the wharves, and if those wharves were so constructed as to prevent the least possible obstruction to the passage of the water in its course along shore, as by building piers sixty or eighty feet apart and connecting them with truss bridges, so as to form a continuous way.

Since the date of my survey the railroad company have torn away their breakwater and extended their wharf six hundred feet further out into the lake. In the construction of this extension they are building the wharf much more open, and also have torn away much of the useless work about the old wharf; and I have been informed by Mr. Smith, the engineer of the railroad, that since the removal of these obstructions the water has deepened around the wharf, and between it and where the breakwater was, some ten inches, and he holds the opinion that the shoal would all disappear if no material obstruction were maintained there.

The importance of a harbor at Milneburg, or some contiguous point on the lake shore, is apparent when the amount of trade carried on through the lake with the coasts of the

various States bordering on the Gulf is considered. The amount of tonnage engaged in this trade is about 578,000 tons yearly; of this amount about 250,000 tons belong to sailing-vessels, varying from thirty to one hundred and fifty tons burden, which are exclusively engaged in this trade. The freight carried by them is of a bulky character, such as lumber, wood, charcoal, cotton, coal, brick, &c., &c., much of which is carried on deck, and therefore especially liable to be lost when the vessels are exposed to heavy weather.

The balance, 328,000 tons, consists mainly of steamboats plying to Mobile and the various ports and rivers along the coast. About half of these boats are of too frail construction to stand much rough weather, and consequently are obliged to withdraw from the trade during the winter season, being the very time during which the greatest amount of freight is carried.

The distance from the canals at Milneburg to the Rigolets, which is the nearest secure harbor or anchorage, is about twenty-five miles, and from the time sailing-vessels leave the canals in going from, or the Rigolets in going to New Orleans, there is no place in which they can find shelter from the sudden and very violent gales that prevail during more than half the year throughout this region; nor can they usually return to either place, because these gales are generally from NNW. to NE., and the course into the Rigolets is NNE.; they cannot lay in, and should they miss-stays, must inevitably be driven ashore. As to the canals, the entrance is so narrow that vessels find difficulty in keeping clear of each other even under the most favorable circumstances, so no resource is left but to anchor and ride out the gale. Were all the vessels provided with the best of ground tackle, and their decks not encumbered with cargoes, disasters would not be of frequent occurrence, although the whole south shore of the lake affords no advantage as an anchorage over the most exposed positions on the coast, save in the holding-ground, the swells being very heavy, and the current setting across them. As is always the case during northerly winds, vessels at anchor seldom ride head to the sea, and consequently there is more rolling, and vessels are more liable to drag their anchor or be stranded; also, the steamboats lying at the wharf are frequently knocked almost to pieces by the heavy swells. Almost every heavy *norther* wrecks or damages some of these coasters and steamers, and I have no doubt that the aggregate amount of property thus destroyed every three or four years would suffice to construct a most ample and secure harbor.

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I remain, very respectfully, your obedient servant,

SAMUEL A. GILBERT, *Assistant.*

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 16.

Report of Lieut. Comg. B. F. Sands, U. S. Navy, assistant in the Coast Survey, to the Superintendent, in relation to Horn Island Passage, Mississippi.

COAST SURVEY OFFICE, *October* 12, 1852.

SIR: Agreeable to the request in yours of the 20th July, I herewith submit a report of Horn Island Passage, with a tracing, showing where buoys should be placed, the positions in red ink. The chart of this part of my season's work being the last one on the programme for office work, has prevented my doing so earlier.

The passage has a channel of seventeen feet water into a good harbor of refuge, under the east point of Horn island, where vessels may anchor in three and a quarter fathoms

water, sticky bottom, sheltered from all winds to the southward of east or west. With the aid of buoys on the shoal spots, as proposed, the channel could be made of much easier access.

Eighteen feet can be taken over the outer bar, which is one and a half mile SSE. from the east point of Horn island, and seventeen feet over the inner bar. Upon the outer bar is a shoal of twelve feet, which should be marked by a spar-buoy, painted black and red horizontally, which could be passed on either side—on the east in eighteen feet, and on the west in seventeen feet. The spit which makes out SSE. from the point of Horn island, to the outer bar on the west side of the channel, has ten feet water upon it close up to the bar and shoals, up to that depth suddenly from eighteen feet, and should have a *black* spar-buoy on it, to be left on the port-hand going in. On the east side of the channel, about half way between the outer and inner bars, on the range of the beacon with the northeast end of Round island, is a shoal of seven feet, which should be marked with a *red* buoy, to be left on the starboard-hand going in; and on the inner bar, on the east side of the channel, is a shoal of ten feet, SE. by E. $\frac{1}{2}$ E., half a mile from the Horn Island beacon, which should have a red buoy on it, to be left on the starboard-hand going in. The shoal of five feet on the Petit Bois side can be avoided by keeping in not less than six fathoms water until the range of the beacon with Round Island light is passed. These buoys, placed as above, would mark the shoal spots in the vicinity of the entrance to the sound; make the sailing directions much less complicated, showing the dangers to be avoided; and vessels of twelve feet draught and under would have a wider channel, passing on either side of the red buoys, while heavier vessels would only have to confine themselves to the channel between them, leaving red buoys on starboard-hand, and black on port-hand, going. On the reduced sketch for publication, I have introduced, in lead, a curve of greatest depth over the bar and into the channel, which I submit for your approval; to be put upon harbor charts, to show the navigator the limit to which he can go with a vessel of the greatest draught that can cross the bar—a guide which I have often desired upon charts when entering a port without a pilot.

Respectfully, yours,

B. F. SANDS,
Lieut. U. S. N., and Assistant Coast Survey.

Prof. A. D. Bache,
Superintendent Coast Survey.

APPENDIX No. 17.

Extracts from the report of Assistant George Davidson, to the Superintendent, in relation to the work executed by the party under his charge during the past year on the coast of California and Oregon.

Astoria, Columbia River, *October* 3, 1852.

Dear Sir: I herewith send my report for the year, embracing the work done by my party. I have already sent you an abstract up to September 1, 1852, for fear I should not be able to give you any later date in time for your report.

The topography of Cape Flattery has been executed, and will be transmitted as soon as inked; it embraces seventeen and a half miles of shore-line and thirteen square miles. The extent is from Sail Rock (see Wilkes,) to include Duncan's Rock and Tatersh island.

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The topography has been executed at the risk of the life of every one at work on it. The only means of conveyance I could furnish was two small canoes, which were forced to land on the rocks and rocky points. Having been at Tatersh in bad weather, I speak advisedly on the subject; but a glance at the topography, and the fact that the whole western swell breaks on the shore from Clisset's village to the west and south, will satisfy you of the dangers encountered and successfully overcome.

The party has suffered much from sickness and accidents. I consider the station to have been occupied at very great risk from the hostility of the Indians; but a knowledge that we were always prepared for any attack, without doubt, prevented one. We built a breastwork, and could fire sixty loads without reloading. Guard was kept six hours every night.

The site on Tatersh for a light-house should, I think, be at the highest point, which is one hundred feet above low water, and a light-house eighty-five feet high would show the light on the horizon at the distance of eighteen miles, so that a vessel, before reaching Flattery Rocks, would be able to see it. The angle of visibility from the land south, round to the extreme visible western point of Vancouver island, is 131°, and from the same round and up the straits is 263°.

Tatersh island is a conglomerate—sides perpendicular; one reef is basalt. There is soil (ranging in depth from six inches to four feet) on the top cultivated by the Indians, who resort there in summer about one hundred and fifty strong. The water obtainable is not good, and there is not very much of it. There is no wood there; it must be brought from the main shore. There is a small landing place in good weather.

Mr. Lawson states that he saw a rock about half way between the island and Duncan's Rock, where the soundings would lead one to suppose it clear of such impediments. The schooner Franklin has gone through there twice, and I suspect many other vessels have done the same. Vancouver's track is marked through it.

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It was and is impossible to carry on any triangulation along the shore where the topography has been executed. The hills are covered with an immense growth of fir and underbrush, and the sides cut up with gullies, rocks, &c.

Enclosed I send you the results for latitude at Scarborough harbor, the apparent places of the stars, and the discussion of the results.

* * * * * * * *

In my records I have designated my last station as at "Scarborough Harbor," from Wilkes; but the name in the English charts is Nee'ah bay, which is the Indian name for the bay: I would therefore propose to call it Neeah bay, (ee as in *peel*,) and if you think it right, could have a note to that effect entered on the records.

By this mail I send duplicates of all the work done at Scarborough Harbor. The difference of longitude from that station to False Dungeness and to Port Hudson, computed and gave to Captain Alden. The latitudes of those places I also gave him from the zenith telescope observations. As I was obliged to sit up two nights successively to get them done by the time he started, I had no time to make a review, or even a very accurate calculation.

I cannot forget to mention the very great aid I have received from Captain Alden, and by the time I reach Mendocino the saving will be about $2,500. In fact I was without funds, and my party would have been idle had he not so willingly conveyed us.

Very respectfully and truly, yours,

GEORGE DAVIDSON.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey, Washington, D. C.

Abstract of observations made by the astronomical party under George Davidson, from October, 1851, to October 1, 1852.

	Port Orford, O. T.	San Francisco, Cal.	Scarborough Harbor.	On the chronometer trips.	Total observations.
LONGITUDE.					
Whole number of observations	628	1,375	836	266	3,105
Observations on moon's I limb	6	34	23	.....	63
Moon culminating stars in connexion with it	22	170	92	.....	284
Observations on moon's II limb	18	22	10	.....	50
Moon culminating stars in connexion with it	92	103	63	.....	258
August 30.—Observed emersion of 30 Piscium; observed moon's transit and difference of declination between the lower limb and 33 Piscium with micrometer of zenith telescope—three observations on each.					3,760
LATITUDE.					
Number of pairs and triplets	50	55	50	74	229
Number of stars	103	123	118	160	504
Whole number of observations	523	753	656	80	2,012
MAGNETISM.					
Number of observations on "term days"	.....	900	480	.....	1,440
Observations for absolute magnetic declination	253	508	223	.....	984
Observations on Polaris and Mark for azimuth	8	18	8	.....	34
Observations for zero of magnets	16	16	18	.....	50
Observations for coefficient of Torsion	8	16	4	.....	28
For horizontal intensity, expts. of deflection and vibration on two days; these include determination of the time of one vibration from the observed time of 300 vibrations	.....	.....	16	.....	16
Deflections at three distances	.....	.....	48	.....	48
For coefficient of Torsion	.....	.....	16	.....	16
METEOROLOGY.					
Observations in connexion with "term days"	.....	768	384	.....	1,152
Whole number of regular observations, (five sets each day, eight observations in each set)	2,320	6,200	2,440	.....	10,960
				Total..	21,233

Difference of longitude, by chronometers, between—	Latitude by zenith telescope.
San Francisco and Santa Cruz, Monterey Bay	Santa Cruz, Monterey Bay.
Do.....do...Point Pinos, Monterey Bay.	
Do.....do...San Simeon Bay	△ San Simeon Bay.
Do.....do...San Luis Obispo Bay	△ San Luis Obispo Bay.
Do.....do...Point Conception.	
Do.....do...Santa Barbara	Santa Barbara.
Do.....do...Prisoners' Harbor	Prisoners' Harbor.
Do.....do...San Pedro	San Pedro, San Pedro Bay.
Do.....do...southeast end of San Nicolas	Southeast end of San Nicolas.
Do.....dc...north anchorage of Catalina	North anchorage of Catalina.
Do.....do...north end of San Clemente	North end of San Clemente, by sextant observations.
Do.....do...Cuyler's Harbor.	
△ at Scarborough Harbor and False Dungeness Bay.	False Dungeness Bay.
△ at Scarborough Harbor and Point Hudson, Port Townsend.	Port Hudson.

The topography of Scarborough Head includes 17½ miles of shore line and 13 square miles. The shore line is bold, rocky, and dangerous. The surf beats upon it continually with the full force of the whole western swell. This topography has been executed at the imminent risk of the life of every one of the party. With the sheet will be sent an abstract of the days on which work could be done, &c.

Each transit observation for longitude is made over nine wires.

Each latitude observation includes the observation upon the north and south stars.

Each mag. observation is the mean of three—the middle one having twice the weight of the others.

Meteorological observations are made upon the barometer and attached thermometer; dry and wet thermometers; directions and force of wind; sky cord, with clouds, in tenths, and characters of clouds.

The apparent places of part of the latitude stars at Port Orford have been reduced from their mean places; all those observed at San Francisco reduced; and all at Scarborough Harbor reduced and reviewed. The latitude of Port Orford deduced from part of the observations; same for San Francisco; and at Scarborough Harbor the whole latitude observations have been computed, reviewed, and the results discussed.

GEORGE DAVIDSON.

APPENDIX No. 18.

Report of Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey, to the Superintendent, on the reconnaissance of the Western coast from San Francisco, south, to San Diego, including the Santa Barbara islands and channel.

U. S. SURVEYING SCHOONER EWING,
San Francisco, February 17, 1852.

SIR: I beg leave to submit the following report in relation to matters connected with the charts which I have the honor herewith to submit.

San Francisco.—Our examinations into the approaches of this harbor have been limited, as a survey of the kind generally is; but I am satisfied that the ranges laid down for the entrance on the admirable survey of Captain Beechey, and revived so often by others claiming paternity to his whole work, are useless, and serve rather to mislead than otherwise: not that there is any positive evil in them, but as such directions occasion delay, and there is evidently no necessity for them, I shall be excused for saying what I have. There are no hidden dangers or anything to prevent the most timid navigator from entering the harbor of San Francisco. He may follow either shore to the northward or to the southward, as close as he pleases, taking care not to get on to Duxbury reef, or the rocks above water which are occasionally met with, lying close along the shore. The reef, however, is not much in the way, as it makes rather along the land, and is less than two miles in length.

As an instance of the inconvenience arising from the ranges above referred to, I will give an example of what is almost a daily occurrence with strangers coming into this port. They find themselves pretty close in with the land, having a leading breeze that would bring them in on that tack without any difficulty; but on referring to the chart, they find certain ranges and directions laid down, to follow which they are compelled to tack ship, and lose, perhaps, a fair tide and a good opportunity to get in. So easy is this port of access, that I consider the services of a pilot even, on ordinary occasions, entirely unnecessary. The bar is frequently rough, and often hazardous to vessels that anchor on it; but it is seldom necessary to do so, for if it should fall calm, the tide will take a vessel over it very quickly, where she can anchor in safety in deep water.

The Farralones.—There are no hidden dangers in this vicinity. A vessel may run *for* and *among* them with perfect safety. The southeastern of these rocky islets is the largest, and so high that on a clear day it is distinctly visible from the entrance of San Francisco, and bears from Fort Point south, 75° west, (true,) distant twenty-nine miles. The middle Farralone is a single rock, about twenty or thirty feet above water. It is distant from the first named about two miles, and a little to the right of eastward of the northwest line of bearing which strikes the remaining cluster. This is made up of five rocks, and about seven miles distant from the largest or first named.

Sir Francis Drake's Bay.—In this bay, close under Punta de los Reyes, there is, I am told, a good and safe anchorage even in a southeaster. Although it appears to afford but little shelter from a wind from that quarter, still, as the point must, from its formation, break off the dangerous southwest swell which always accompanies a gale from the southeast, I am persuaded that some confidence should be placed in the information. A closer examination into the matter will, however, settle a question of such vital importance to vessels bound to San Francisco during the winter season.

From Point Lobos, the southern point of the entrance to San Francisco, the first point or headland arrived at in going south is *Point Piedra*, oftener called *Point San*

Pédro—a misnomer, I think, not only because that saint has already *shared* largely in such distinctions on this coast, but because it is a high, rocky promontory, and would naturally receive a name as being somewhat descriptive. *Point Ana Nuevo* is next in importance, and is easily recognised from a similarity that its extremity bears to a small islet. Having passed this poin , and following along the shore, you begin gradually to enter the *Bay of Monterey*, and soon open the anchorage of *Santa Cruz*. This is a town of no little importance, and is the depot of one of the most productive agricultural districts in California. The course from this point to Monterey is south, 20° east, (true,) and distant twenty-two miles. This is a safe anchorage all the year round; but so far as business is concerned, *Monterey* seems to be at a stand-still. Continuing the course to the southward, after passing round Point Pinos, the first remarkable headland met with is Point Sur, or Lobos. This is a good mark for vessels coming either way, and cannot be mistaken. Ten miles distant it appears like a large round island. There is a tolerable anchorage about two miles to the southward of this point; but the rocks in the way make it difficult of access, and it should not be attempted unless circumstances make it necessary. Between this point and Point Simeon (where there is a fine cove and a good summer anchorage) there is little or no shelter to be had. The "*Moro*," a high conical rock lying in Esteros bay, is a good landmark, particularly for vessels coming from sea. Behind it, I am informed, there is quite a body of water, partaking somewhat of the character of a lagoon, as the name of the bay implies. The next in order is the anchorage of *San Luis Obispo*. There is no settlement near the beach, and the landing is often bad. The best, however, will be found in the creek at the west end of the beach. Whenever it is practicable, going in, keep the rocks at the entrance on your starboard hand. About five miles to the southward and eastward of San Luis Obispo the sand-hills commence, and the land close to the shore is lower than anywhere else, until you get to *Point Sal*, which is much higher and covered at intervals with streaks of yellow sand, except at the extreme point, which is formed by high, round, black rocks, to seaward of which are several sunken rocks extending half a mile to the southward and westward. At about five miles to the southward of Point Sal the sand-hills commence again, but are more or less covered with patches of grass, while the land is higher than to the northward.

La Purissima Point is comparatively low and sandy; a quarter of a mile off from it are several rocks awash. Between this Point and La Purissima river there is a long range of table land from 150 to 200 feet high.

For *Points Arquilla* and *Conception* see the sketch.

From the last-named point to *Santa Barbara* the coast is almost straight, and runs nearly east and west. The passage formed by the islands lying abreast this portion of the coast is called *Santa Barbara channel*. The first or most eastern one is called *San Miguel;* it is about eight miles long and three and a half broad; on the north side of it is a very good anchorage, which I have named "*Cuyler's Harbor*," in honor of one of the officers attached to the party. Water can be obtained there at any time in the ravine just above the landing, and by digging in the sand at the eastern extremity of the beach. I will refer you to the sailing directions for observations, and the dangers lying off the northwest end of this island. *Santa Rosa* comes next in order; it is fifteen miles long, and nine miles broad. There are, it is said, now on this island 10,000 sheep, the enormous increase of 75 animals placed there about eight years ago.

Santa Cruz, which is the largest of this group, is the next island to the eastward, distant six miles; it is about 21 miles long and from 4 to 5 miles wide. There are a few cattle

here, but, like all the other islands, there are no inhabitants. *Prisoners' Harbor* is on the north side of the island, and near the middle of it; at this point there was some years ago a penal settlement, from which the name of the anchorage is derived. Wood and water can be procured here in abundance and with little trouble; the course and distance from this harbor to Santa Barbara is north by west by compass, and twenty-five miles. *Anacapa* is a high, rocky island, bearing east from Santa Cruz, and a little more than four miles distant. It is four miles long, and exceedingly narrow, abrupt and jagged, with an occasional break through it, evidently made by the action of the water. From the east end of Santa Cruz, the island of *St. Nicolas* bears south (true) 42 miles. This island is nine miles long and four miles broad; I have described the dangers, including Begg's Rock, off the northwest end, in the sailing directions. North 61° east, and distant twenty-six miles from the centre of St. Nicolas, is the island of *Santa Barbara.* It is two miles long, and one mile broad; it is entirely inaccessible, except on the east side. Great numbers of walrus, or sea-lions, and seal, frequent this island.

The northwest end of *Catalina island* bears east (true) from the last-named island, and is about twenty-two miles distant. This island is seventeen miles long, and its greatest width a little more than five miles. The land is high—almost mountainous; some distance off, and abreast of it, it appears like two islands. At the point where the land is so low, are the two anchorages. The one on the southwest side has been surveyed, and the chart is herewith sent; it is very small, and perfectly land-locked, by a low, narrow point, jutting out from the east side. The anchorage on the opposite side of the island will only answer for southeasters. Goats are seen here in great numbers. The course from Catalina harbor to the northwest end of *San Clemente*, (the eighth and last,) is south 10° west, (true,) and twenty-three miles distant. This island is eighteen miles long, and from three to four miles broad. There is an anchorage under the southeast end, which affords sufficient protection during the summer months.

After finishing the examination of the above-named islands, we steered down to the southward and westward, so as to get on the parallel of latitude well to the westward of certain dangers said to exist somewhere between that point and the *Coronados island.* Our search was not entirely unsuccessful, for we fell in with a bank, where the shoalest water we found, however, was forty-two fathoms, fine white sand. For many reasons, our examination was limited, as the track will show, and I should not, therefore, be willing to say that there are no dangers existing in that quarter, particularly as one of the shoals laid down was discovered by the U. S. frigate Constitution, in January, 1840, and I happened to be one of the officers who *believed* they saw it at the time. I shall improve the first opportunity to give that locality a more thorough examination. Proceeding eastward, we fell in with and examined the Coronados islets. The group is composed of four detached rocks, and occupies a space of about five miles, three of them being nearly in a line with each other. Continuing on, we fixed our work to the initial point, and then proceeded to San Diego. After remaining there a few days, the work was again commenced, and the coast-line put in between Point Loma and Santa Barbara, the place where we struck off for the islands. Proceeding north, the work was re-examined, where it was necessary, and corrections made. On the last of November we returned to San Francisco, after an absence of only five weeks.

The weather favored us in a great degree; but to the hearty co-operation and untiring exertions of those who are associated with me is due the successful termination of this very important work, and it is with no ordinary feeling of gratefulness that I bear testimony to their zeal and fidelity. At the same time, permit me here to acknowledge to you my

sense of obligation for the manner you have sustained me in a situation which was, under the circumstances, exceedingly embarrassing.

With great respect, I am, very truly, your obedient servant,

JAMES ALDEN,
Lieut. Comg. U. S. Navy, and Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 19.

Extracts from the report of Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey, to the Superintendent, on a reconnaissance of Shoal Water bay, Oregon.

U. S. SURVEYING STEAMER ACTIVE,
Astoria, Columbia River, October 4, 1852.

DEAR SIR: We have just arrived from Cape Flattery with Mr. Davidson and his party on board, all in good health. Since leaving here on the 11th ultimo we have made a reconnaissance of the entrance of Shoal Water bay and all the northern portion of it, comprising an area of about one hundred square miles: the remainder, which we were prevented from examining for want of time, is a broad sheet of water from four to five miles wide, and extending in a southerly direction to within four miles of Baker's bay, Columbia river, and is shut out from the sea by a narrow peninsula which commences just behind Cape Disappointment and runs due north some twenty-five miles, forming at its terminus the south point of the entrance. It is full of shoals, as its name implies, but there is plenty of water among them, and they are generally bare at low water; the opening is a little more than five miles wide between the sand spits. There are two good channels more than half a mile wide, with three fathoms on the bars at low water; they are easily found and quite accessible. The land is well timbered, and I suppose there is plenty of it sufficiently good for agricultural purposes. At present there are no whites on the bay, except a few who are employed in collecting oysters (which abound in great numbers) for the California market. * * * *

With great respect, I am your obedient servant,

JAMES ALDEN,
Lieut. Comg. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent Coast Survey.

APPENDIX No. 20.

Extracts from letters of Assistant R. D. Cutts, U. S. Coast Survey, to the Superintendent, dated June 11th and 20th, at Columbia river, in relation to the channels, and Lieut. Comg. McArthur's survey of that river.

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I arrived here yesterday, twelve days from San Francisco, having left that harbor on the 29th of May. The passage was an unusually short one for this season of the year, the average length being two weeks.

I entered by the south channel, with a pilot aboard. The only change that has occurred since McArthur's survey is the gradual extension southwardly of the south point of the

Middle Sands, and of the south point of the North Breaker, being the outer limits of the south and north channels respectively. The south channel is still the favorite—indeed, the only one used.

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So far as I have had an opportunity of judging, the survey made by Lieut. McArthur is deserving of every encomium that has been passed upon it. Considering the difficulties he had to contend with—a crew ready to desert on the first opportunity, and a river full of dangers, requiring patient labor and close examination—his chart of the mouth of the Columbia is a brilliant proof of his skill and indomitable energy.

APPENDIX No. 21.

Extracts from the report of Major I. I. Stevens, U. S. Corps of Engineers, assistant in charge of the Coast Survey Office, to the Superintendent, upon the subject of printing from lithographic transfers.

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I have given, during the past year, great attention to the subject of printing from lithographic transfers, in connexion with the publication of the annual report. The Secretary of the Senate did me the honor to request that I would procure the sketches of the Senate copies of your annual report—sixty-four in number, and included in fifty-nine plates—to be printed by the most reliable persons, and in the best manner. After many inquiries, both in Philadelphia and New York, the work was given to Mr. James Ackerman and to Mr. David McLellan, of New York. To Mr. Ackerman were given forty-three, and to Mr. McLellan sixteen plates. My general assistant, Lieut. E. B. Hunt, Corps of Engineers, was sent to New York, with directions to examine thoroughly the whole subject, do all he could to improve the methods, and by frequent inspections to insure the best quality of work, rejecting everything of an inferior quality. In consequence of this course the sketches are very superior to those of former years, and do great credit to the skill of the lithographers.

By the electrotype process the plates of the annual report could be indefinitely copied, and the whole number of impressions be executed by a copperplate press; but the expense is very considerable, and with the excellent work which the lithographers can now furnish by printing from lithographic transfers, it is not required.

The transfer process is briefly as follows: Sheets of firm thin paper, which expand on wetting as little as possible, are brushed over with gelatine or some other glazing substance, and then with a coating of flour or starch-paste, which is pressed or polished to a smooth surface. On this paper copperplate impressions are taken, as usual, except that a peculiar very fine ink is used, which is carefully worked into the engraved lines by dabbing on the heated plate. These impressions are laid with the printed face downwards on the polished lithographic stones, and run through a lithographic press. By wetting the back of the paper left adhering to the stone, the face-coatings are so much softened that the paper can be smoothly stripped off, leaving all the ink, before on its printed surface, firmly adhering to the stone, and presenting, after washing, a perfect reversed drawing, like the engraved surface of the original plate.

All lithographic printing is founded on the porosity of surface structure characterizing lithographic limestone, whereby it strongly retains, when ground down and polished, a coating of water, oil, or fat, by a uniform adhesion. A charged ink-roller may be rolled

at will over such a surface, when fully wetted, without depositing any ink, for the ink only touches the water-coating, to which it does not at all adhere. But if we trace ink-lines on the dry stone, the oil or fat of the ink firmly adheres, and perfectly turns the water from the lines. Thus, while the stone is wet, the lines are dry, so that in rolling the face of the stone with a charged ink-roller, the ink is deposited upon, and adheres to, the ink-lines, and nowhere else. These lines being thus charged, a sheet of printing-paper is laid smoothly on the stone and run through the press. The surplus ink is thus taken up by the paper; on removing which, it presents a direct impression, which, after drying and pressing, is ready for use. In the lithographic printing-press the stone is bedded on a horizontal frame, running on rollers, and bearing a broad leather tympan, which folds down on the sheet when spread over the stone. The frame is then drawn, by a crank movement, on the bearing rollers, under a fixed scraper, which slides along the tympan, and thus brings the paper into close contact with the stone, by the action of a powerful sliding pressure.

In transfer printing, as in printing from crayon, pencil, or ink drawings, on stone, the effect of long use is to spread the principal lines, and to break or obliterate the finest ones, so that, after a time the drawing or transfer requires renewal. Constant care is needed to prevent the use of imperfect or injured transfers, and to check the tendency to slovenly inking, whereby fine lines are not brought out, and the broader ones are spread and made uneven. It matters not how perfect may be the transfers if carelessness be permitted in the printing, for thus the best transfers are soon ruined, and all delicacy of impressions lost. With the same plate, excellent or wretched transfers may be made, according to the paper, transfer-ink, presses, &c., used, and according to the skill or carelessness of the transferer; while with the best possible transfers, poor impressions must result from lack of care or skill in the printer. In few branches of business is there so great a necessity for thorough or vigilant supervision, in order to secure a satisfactory result. The total disregard of taste and style in the great mass of lithographic work has vitiated the workmen, and prevents their doing justice to the plates or transfers put into their hands. Cheapness has been so nearly the sole requisite, that style has been sorely neglected, and the capacities of a beautiful process left but imperfectly developed. From first to last, there has been too slight attention to the points whereon success depends.

The engraving of the plates must have a special adaptation to this transfer process. To give solid transfers in which the finest lines shall appear clear and unbroken, the engraver should enter them firmly into the plate, so that the lines will hold sufficient ink to bear the necessary wiping, and yet leave a full ink-line on the stone. Light machine ruling, faint etching, close-lined marshes, scales and water-lines, cross-lining in clouds or shading, broad stroke stump lettering with fine hair-lines, and other details of ordinary engraving, are peculiarly unfit for transfer printing, because they are either lost or so filled with ink as to run together, or become blotched, after printing a small number, thus destroying the expression and harmony of the entire plate. It is particularly important, therefore, for engravers to study this adaptation of style in plates for transfer printing, and not to be governed entirely in managing details by their working copperplate proofs. By this means, fine pictures may be ultimately printed by transfer, to the great advantage of art.

Careful treatment of the engraved plates, while in the lithographer's hands, is essential to their preservation; and without this, scratches, and ink hardened in the lines, make nearly worthless the plates so laboriously prepared. On no account should the finely-engraved topography of the Coast Survey plates be subjected to the rough handling or bad packing of irresponsible or careless persons. Lack of care in waxing and papering

the engraved surfaces, or in excluding sand or grit from them, will insure their ruin during the jars of transportation.

In transfer printing, the kind of paper used is of special importance, and should be provided with particular reference to this use. A highly-sized paper rapidly wears away the transfer from the stone, requiring frequent renewals; but without some sizing, little printing-paper has the requisite strength or solidity for large, elaborate maps. Alum and some other ingredients commonly used in making paper, prove ruinous to the transfers, and quickly destroy all their delicacy. The texture of the surface is also an important element, for while it should be harsh enough to have some mechanical action on the ink-lines, or "a tooth for the ink," it should be smooth enough to touch the stone evenly over its entire surface, else some fine lines will fail to print full, and the amount of slipping will spread the heavier lines. In printing on soft, thick paper, the surface texture is less important, as it gives sufficiently to the pressure to make a thorough contact.

It is also particularly important in transfer printing to use clear, fine ink, free from grit, and of a durable, brilliant black. Its consistency should be such as that the lines, when charged, should print a solid black instead of a gray or thin black. Neither should lines be permitted to lump up or spread. By care in securing pure materials, and in mixing them, great improvements can still be made; and it is possible, as has been shown, to give to transfer impressions as pure and rich a black as results from the full copper-plate lines. The entire flatness and want of relief in transfers on the stone, and the fact that the difference in depth in engraved lines is not reproduced on the stone, makes the management of the printing, so as to resemble copperplate proofs, a matter of considerable difficulty, and quite impossible if the ink is carelessly managed.

To secure good transfer printing, then, requires care in all the steps from the original engraving to the final drying and pressing. Numerous details must be steadily observed and cared for by those who have an interest in the style, and an eye for the quality of impressions. By making these matters subjects of careful study and experiment, much will still be done towards perfecting the art; a result so desirable as to justify every effort and a liberality of remuneration for its full attainment.

I am particularly indebted to Lieut. Hunt for the large amount of interesting and valuable information on this and other subjects, furnished by him whilst occupied on the duty of supervising the printing of the sketches for nearly seven months in New York. It has caused a decided improvement in our sketch work; has led to friendly relations with many of the largest engraving, lithographic, printing, and map-publishing establishments in that city, and has not only placed at the disposal of the office larger resources to expedite work in an emergency, but has actually had a tendency to improve, and has improved, the several departments of the office. The good work, then, commenced by Lieut. Hunt, I am desirous should be continued.

Besides the above duties, Lieut. Hunt acted as a general agent for the office in that city, securing the services and supervising the work of engravers on contract, purchasing paper, instruments, and other materials for the office, and generally procuring information on points as they arose. His services in this respect have convinced me that advantage would result to the Survey from its having permanently in that city an assistant of high qualifications as a general agent.

In this connexion it is no more than due to say, in behalf of the lithographers, Messrs. Ackerman and McLellan, that they throughout showed the most praiseworthy desire to respond to any suggestion made by Lieut. Hunt to improve their work. They spared no expense either in procuring the best paper and other materials, or in securing the services of better transfer men and printers, actually sending for experienced men abroad, or in

repeating their transfers until they were of the highest character, before proceeding to print. The contract price, too, was low, and I am satisfied Mr. Ackerman must have been a serious loser by the operation. He is a man of great capacity for business, and both he and Mr. McLellan are determined to merit the continuance of government patronage by their skill, fidelity, and promptitude.

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APPENDIX No. 22.

Additional notes of a discussion of tidal observations made in connexion with the Coast Survey at Cat Island, in the Gulf of Mexico, by Professor A. D. Bache, Superintendent U. S. Coast Survey. (See Sketches.)

In my communication on the subject of the tides at Cat island, coast of Louisiana, at the New Haven meeting of the American Association, I showed that I had succeeded in decomposing the curves of rise and fall into a diurnal and semi-diurnal curve, which were nearly curves of sines; the diurnal curve having its maximum approximately nine hours in advance of the first maximum of the semi-diurnal curve, and the interference of these two waves producing the tidal waves as observed. The comparison of the curves deduced from the observations for three months, and the computed curves of sines, was shown to be satisfactory. This comparison, made as before by averages of periods of a week combined into one general mean, has now been extended to the whole year, as shown in the subjoined table. By increasing the maximum ordinate of the diurnal curve 0.02 of a foot, which will make the rise and fall agree more nearly with the average deduced from observation, we obtain, as shown in No. 2, a resulting curve not differing in any ordinate more than a quarter of an inch from observation, and in which the positive and negative errors nearly balance, and the mean error deduced by summing the square of the errors is little more than one eighth of an inch.

TABLE No. I.—(Diagram No. 1:)

Showing the comparison of diurnal and semi-diurnal curves deduced from observation, with curves of sines.

Hours from first mean level of water.	No. 1. FROM OBSERVATION.			No. 1. FROM CALCULATION.			Observation—Calculation No. 1.	No. 2. FROM CALCULATION.			Observation—Computation No. 2.
	Diurnal curve.	Semi-diurnal curve.	Mean tidal curve.	Diurnal curve.	Semi-diurnal curve.	Mean tidal curve.		Maximum ordinate diurnal curve increased 0.02 foot.	Semi-diurnal as before.	Resulting mean tidal curve.	
	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.	ft.
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00
1	.17	—.03	.14	.15	—.04	.11	.03	.15		.11	.02
2	.31	—.06	.25	.28	—.07	.21	.03	.29		.22	.02
3	.44	—.08	.36	.40	—.08	.32	.03	.42		.34	.02
4	.51	—.06	.45	.50	—.07	.43	.02	.51		.44	.00
5	.56	—.03	.53	.55	—.04	.51	.02	.57		.53	.00
6	.57	.00	.57	.57	.00	.57	.00	.59		.59	—.02
7	.56	+.03	.59	.55	+.04	.59	.00	.57		.61	—.02
8	.51	.06	.57	.50	.07	.57	.00	.51		.58	—.01
9	.44	.08	.52	.40	.08	.48	.03	.42		.50	.02
10	.31	.06	.37	.28	.07	.35	.01	.29		.56	.00
11	.17	.03	.20	.15	.04	.19	.01	.15		.19	.00
12	.00	.00	.00	.00	.00	.00	.00	.00		.00	.00

Same as foregoing.

Nothing would be gained in closeness of representation of the result by displacing relatively the two tidal waves. It is only remarkable that in averages including the whole of the tides, even when most irregular, the results are so satisfactory. I have accordingly used the hypothesis of the representation of each wave by a curve of sines, deducing the maximum ordinate by computation from each observed ordinate. These laborious computations were made by Alexander S. Wadsworth, junior, sub-assistant of the Coast Survey, and by Mr. P. B. Hooe. They gave tables of heights of the diurnal and semi-diurnal curve for each day of observation, which form the basis of the discussion of the heights. The next step after decomposing the curve of observation into diurnal and semi-diurnal curves, is to discuss each separately, to ascertain if they follow the laws deduced from them in regard to heights and times.

I. DIURNAL WAVE: HEIGHTS AND TIMES.

If the diurnal curve is a curve of sines, then the ordinates found for each hour enable us to determine the value of the maximum or six-hour ordinate. Setting out from the mean line, then, we have for each day six determinations of the rise or fall above or below that line. Tables were computed from these, in which the daily curves were decomposed into their diurnal and semi-diurnal components. In making these tables, the very irregular tides have been in general omitted. These tables were arranged according to the moon's declination, beginning and ending with the days on which the declination was zero, determining the maximum ordinate of each day from zero of declination. As the irregular tides occur near the time of the moon's passing the equator, the averages of the heights about these times are deduced from a less number of observations than the others, and are therefore less reliable. The following table gives the average heights, with the number of days from which they have been deduced. No advantage resulted from displacing the epoch of the moon's declination relatively to the day of highest tide.

TABLE No. II.—(DIAGRAM No. 2:)

Showing the value of the maximum ordinates of the diurnal curve, on the several days from zero of declination of the moon to zero again, with the number of days from which the results are deduced.

Days from zero of declination	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. observations.														
Heights.....	0.33	0.33	0.32	0.41	0.59	0.65	0.78	0.77	0.87	0.85	0.77	0.70	0.58	0.51
Nat. sin. 2 × moon's declination	0.05	0.11	0.12	0.24	0.41	0.46	0.52	0.58	0.60	0.59	0.54	0.46	0.37	0.27

The dependence of the height of the diurnal wave upon the moon's declination appears by comparing the lowest line of the table, containing the sine of twice the moon's declination, with the line next above it; it is also shown by the curves of Diagram No. 2. This agrees with Mr. Whewell's approximate formula for the diurnal inequality, namely: $dh = \text{C. sin } 2\delta'$; in which dh is the difference in height of two consecutive high or low waters, C a constant, and δ' the moon's declination.

The variation of this same height with the sun's declination may be made at once apparent by classifying the heights for different values of the sun's declination with the same

declination of the moon. The following table contains the greatest heights of the diurnal curves during the several lunations of the year, with the values of the sun's declination, and of the moon's declination, grouped as described in the several columns.

TABLE No. III.—(DIAGRAM No. 3:)

Showing the effect of change of sun's declination on height.

Natural sine 2 sun's declination.	Number of lunations in group.	Natural sine 2 moon's declination.	Maximum ordinate diurnal curve.
Greater than 70°.....	5	.572	1.02
70 to 60	6	.577	0.99
60 to 40	6	.565	0.93
40 to 20	5	.530	0.94
20 to 00	4	.550	0.74

The effect of the change of parallax of the moon may be shown satisfactorily by grouping the values of the heights at the greatest southern declination of the moon, and for the greatest northern declination, for the year; comparing them for slightly varying declinations of the moon, for mean declinations of the sun, and for large variations of the parallax. The result is as shown in the following table, and in Diagram No. 4.

TABLE No. IV:

Showing the effect of change of moon's parallax on height.

Number of results.	Mean sine 2 moon's declination both series.	Mean sine 2 sun's declination both series.	Mean parallax correction for 1st series.	Mean parallax correction for 2d series.	Mean height for lesser parallax.	Mean height for greater parallax.
13½	59.4	48.5	52.9	65.9	0.74	0.88

The parallax correction is taken as the cube of the parallax multiplied by the sine of twice the moon's declination.

These are the principal variable terms in the formula derived by Mr. Lubbock, from Bernouilli's theory of the tides, for the diurnal inequality, namely:*

$$dh = \mathrm{B}\,[\mathrm{A}.\ \sin 2\delta.\ \cos(\psi - \varphi) + \sin 2\delta'.\ \cos\psi];$$

in which dh is the difference in height of the morning and evening tides, B and A are constant coefficients, δ' is the moon's declination and δ the sun's; ψ is a small variable to be added to the mean lunitidal interval to give the interval corresponding to the moon's age, and φ is the hour angle of the moon at the time of transit. The second term, introducing the parallax of the moon, would be

$$m.\ \frac{\mathrm{P}'^3}{\mathrm{P}^3}.\ \sin 2\delta';\dagger$$

in which m is a constant coefficient, P is the mean parallax, and P the parallax at the time under consideration.

*Transactions of the Royal Society of London, 1836, p. 223.

† Lubbock's Elementary Treatise on the Tides, London, 1839.

In the application of this formula to the observations, the maximum ordinates, found as before stated, were tabulated; and first the coefficients were deduced from the cases corresponding to the maximum of the sine of twice the moon's declination and to the minimum of the sun's, and *vice versa*, neglecting the small variations due to cos $(\psi - \varphi)$ and cos ψ. This gave the following values for the coefficients, and the two sets of equations derived conformed with each other.

TABLE No. V:

Showing the value of coefficients deduced from maximum sine twice moon's declination, and minimum of sun's, and vice versa; neglecting variations due to cos $(\psi - \varphi)$ and cos ψ.

	B. cos ψ.	B. A. cos $(\psi - \varphi)$.
First six months	1.07	0.43
Second six months	1.00	0.39
Whole year	1.04	0.52

As each day's results are referred to the mean level of the day, and the mean of the low and high waters is taken as giving the height of the diurnal tide, the constant from the mean level of the whole should not appear in the values. In beginning these researches, I did not suppose that small differences would come out of them, such as have been deduced. The reference to the level of each day compensated, in a degree, for the effect of an entire raising or depressing of the water by the wind's action.

The results promising success, the coefficients were deduced by the method of least squares for the first, and then for the second six months, and finally for the whole year. These laborious computations were made with much skill by Mr. W. W. Gordon, of the Coast Survey. The result for the second six months, in reference to the coefficient of the sun's declination, is discrepant from the final result; but as the coefficients for the whole year were used, after endeavoring to trace the error, if any, without immediate results, it was not pursued further.

TABLE No. VI.

Coefficient of cos $(\psi - \varphi)$, deduced from method of least squares.

	B. cos ψ.	B. A. cos $(\psi - \varphi)$.
First six months	1.00	0.26
Second six months	0.90	0.60
Whole year	0.96	0.24

The sums of the positive and negative quantities balance rather better by the use of the coefficients from the first method, which differs chiefly in the coefficient of the sun's action.

The coefficient of the first term of dh is $B \times (A,)$ and of the second term B; and it will be seen hereafter in discussing the semi-diurnal tide, that (A) is 0.364, which, with $B \times (A) = 0.26$, gives $B = 0.96$. The value 0.24 agrees, therefore, very well with that deduced by this different process.

A set of tables was next made, containing the values of the two terms of the formula for each day. To these was subsequently applied the small correction for the parallax from the term $\frac{P'^3}{P^3}$; and the terms, being summed, were compared with the observed maximum ordinate, and the difference in the final column of the table showed the residual to be accounted for.

For these tables I am indebted to Lieut. Trowbridge, of the Corps of Engineers, assistant in the Coast Survey. The tabular quantities were also traced in curves, and then compared with the maximum ordinates. The positive and negative differences are usually small, not exceeding in the average about 0.12 of a foot, and are quite irregular.

The irregularities apparent in the phenomena themselves induced me, in first commencing this investigation, to hope merely to be able to trace the phenomenon generally; but it now appears, from the character of the results obtained from the averages, that the theory may be followed by the results much more closely than I had at first supposed.

The accordance of observation and theory, after the corrections have been applied, is as good as the accidental errors of the separate results render necessary; as will be seen from the results for July given in the annexed table, and for July and part of August as given in Diagram No. 5; but as the average seemed to indicate that the residuals would show the laws of the phenomena, I discussed them further.

TABLE No. VII:

Showing the value of maximum ordinates of the diurnal curve, computed from the moon's declination and parallax, and from the sun's declination, compared with ordinates from observation, for the month of July.

[Part of a table for the year.]

Days.	Maximum ordinate.	$0.96.\frac{P'^3}{P^3}.\sin 2\delta'$.	0.26. sin 2 δ.	
July 1	1.43	.66	.19	.60
2	.93	.59	.19	.17
3	.96	.35	.19	.43
4	.75	.33	.19	.26
5	.62	.22	.19	.17
6	.37	.08	.19	.10
7	.35	.14	.19	.12
8	.36	.14	.19	.03
9	.32	.25	.18	—.09
10	.52	.34	.18	.01
11	.65	.42	.18	.07
12	.75	.47	.18	.15
13	...	.54	.18	...
14	.78	.52	.18	.10
15	.73	.53	.18	.02
16	.62	.55	.18	—.10
17	.89	.53	.17	.19
18	.93	.48	.17	.29
19	.61	.40	.17	.06
20	.52	.15	.17	.20
21	.57	.00	.17	.40
22	.41	.02	.17	.22
23	.56	.33	.17	.07
24	.65	.45	.17	.05
25	.61	.55	.16	—.08
26	.77	.63	.16	.00
27	.90	.65	.16	.12
28	.86	.65	.16	.08
29	.90	.56	.16	.10
30	.90	.48	.16	.27
31	.69	.37	.15	.18

In looking for an explanation of the irregularities to the terms (ψ—φ) and ψ, the residuals were classed according to the moon's age, and the averages taken for the separate hours. The result of these tables is given in that annexed, which shows the residual for each six months and for the year. I have introduced them for the half year, to show that the same law is deducible, notwithstanding the irregularities of the individual results from the observations for each six months.

TABLE No. VIII.—(Diagram No. 6:)

Showing the residuals from the comparison of observed and computed ordinates of diurnal curves, classed according to the ages of the moon.

Hours of moon's transit.	RESIDUALS.		
	First six months.	Second six months.	Mean.
$0\frac{1}{2}$	.23	.21	.22
$1\frac{1}{2}$	.17	.12	.13
$2\frac{1}{2}$	.15	.15	.15
$3\frac{1}{2}$	.15	.12	.13
$4\frac{1}{2}$	.16	.00	.08
$5\frac{1}{2}$	.08	—.03	.02
$6\frac{1}{2}$	.06	—.03	.01
$7\frac{1}{2}$	.08	—.02	.03
$8\frac{1}{2}$	.13	.04	.08
$9\frac{1}{2}$	.12	.12	.12
$10\frac{1}{2}$	.09	.14	.11
$11\frac{1}{2}$	.19	.14	.16

These residuals, instead of following the law of cos (ψ—φ,) follow that of cos (2ψ—2φ,) or that of the semi-diurnal curve.

Before examining this result, which is shown in diagram 6, I pass to the residual which is found by carrying on the former table to $23\frac{1}{2}$ hours; which was in fact the form of the table before the development of the law of variation showed that the term for $12\frac{1}{2}$ hours belonged to $0\frac{1}{2}$, instead of $11\frac{1}{2}$, with which it would agree if the law of cos (ψ—φ) were followed. The following table contains the residuals in question, shown also in diagram No. 7.

TABLE No. IX:

Showing residuals after deducting those following law of change of cos (2ψ—2φ).

Age of moon.	Residuals.	Age of moon.	Residuals.
Hours.	*Feet.*	*Hours.*	*Feet.*
$0\frac{1}{2}$	—.07	$23\frac{1}{2}$	—.01
$1\frac{1}{2}$	—.02	$22\frac{1}{2}$	—.01
$2\frac{1}{2}$	.01	$21\frac{1}{2}$	.01
$3\frac{1}{2}$	.03	$20\frac{1}{2}$	.03
$4\frac{1}{2}$	.00	$19\frac{1}{2}$	.02
$5\frac{1}{2}$	.01	$18\frac{1}{2}$	.04
$6\frac{1}{2}$	.05	$17\frac{1}{2}$	.08
$7\frac{1}{2}$	.04	$16\frac{1}{2}$	.09
$8\frac{1}{2}$	.07	$15\frac{1}{2}$	.04
$9\frac{1}{2}$	.02	$14\frac{1}{2}$	.00
$10\frac{1}{2}$	—.03	$13\frac{1}{2}$	.03
$11\frac{1}{2}$	.03	$12\frac{1}{2}$	.06
Mean.....	.....		.03

The existence in the first residuals of the law belonging to the semi-diurnal curve indicates that the separation of the two curves (diurnal and semi-diurnal) is not complete, as indeed the hypothesis of a constant difference in time between the recurrence of the two maxima requires. Before undertaking to modify this hypothesis, I proceeded to inquire whether these numbers would receive modification from any other source. In examining the hypothesis that the component curves were curves of sines, a separation of the several hourly ordinates was necessary, and thus the four points at which the curves for twenty-four hours cross the line of mean level were brought into consideration each day. Two of these points varied necessarily considerably in position, while the two twenty-four hours apart were regular. Having found that the curves of sines represent very nearly the observations, the law thus obtained may be used in computing from all the hourly observations of the day the values of the maximum ordinates for each curve; forming the ordinates of the observed curve into groups containing respectively the same positive and negative values of the ordinates of the diurnal curve, and again of the semi-diurnal, arranging the groups for the consecutive twenty-four hours. It was soon apparent that the ordinates for the semi-diurnal curve would in this way prove more considerable, in the average, than in the former mode of computation, and that the results would be more regular; that the ordinates of the diurnal curve would, on the average, be slightly diminished, and in general prove more regular. These revised tables have been prepared chiefly by Mr. W. W. Gordon and Mr. P. B. Hooe. They show on the average of the year a diminution of the maximum ordinates of the diurnal curve of 0.04 foot, and an increase of the maximum ordinates of the semi-diurnal curve of 0.07 foot.

Classifying the corrections according to the moon's age, though they are irregular, it is apparent that there were entangled in the values of the former computed maximum ordinates, heights which belonged to the semi-diurnal curve. The table of corrections for the two periods of six months, and for the year, is given below.

TABLE No. X:

Showing the difference of maximum ordinates of diurnal curves, as computed by the last method of groups, and by that first applied.

Hours of moon's transit.	Correction of maximum ordinates diurnal curve.		
	First six months.	Second six months.	Mean of year.
Hours.	*Feet.*	*Feet.*	*Feet.*
0½	—.10	—.06	—.08
1½	+.03	+.03	+.03
2½	—.08	—.02	—.05
3½	—.08	—.09	—.08
4½	—.08	—.09	—.08
5½	—.03	—.05	—.04
6½	—.02	—.02	—.02
7½	—.05	+.02	—.01
8½	+.01	+.02	+.01
9½	—.05	—.03	—.04
10½	—.08	—.03	—.05
11½	—.03	—.04	—.03

A consideration of the general formula for the height indicates a second correction. The height of high water, as given by the formula, is not the sum of the two greatest heights of the diurnal and semi-diurnal tides. The hypothesis of the interference of the two waves

makes the high water the sum of two ordinates (neither of which is the maximum) depending upon the laws of increase and decrease of the curves respectively, and of the relative position of the two ordinates. The correction due to this cause is readily found. The part of it which belongs to the diurnal curve will be the difference between D and D. cos (t—E;) where E, according to the hypothesis of the interference of the two waves, is 9 hours; and t is the value for the maximum ordinate of the compound curve, namely, (Proc. Amer. Assoc. New Haven Meeting, page 289,)

$$\text{cosec } t - \sec t = \frac{4\,C}{D\sqrt{\frac{1}{2}}}.$$

This value of t, containing C (the maximum ordinate of the semi-diurnal curve) shows that the quantity will vary with the time of the moon's transit, according to the half-monthly inequality of the height. Following the course which I have taken throughout this communication to give the resulting tables merely, I subjoin the corrections thus derived from the tables for $\frac{4\,C}{D\sqrt{\frac{1}{2}}}$ from observation, the computed values of t, and of D. cos (t—E.) The agreement of the general form of this correction with theory is a new confirmation of the values of the quantities C and D, deduced from observation, which it contains.

TABLE No. XI:

Showing the correction to height of the diurnal wave for difference of maximum ordinate, and of high water ordinate in compound curve.

Time of moon's transit.	Correction to maximum ordinate diurnal curve.
Hours.	*Feet.*
$0\frac{1}{2}$	—. 03
$1\frac{1}{2}$	—. 05
$2\frac{1}{2}$	—. 03
$3\frac{1}{2}$	—. 04
$4\frac{1}{2}$	—. 04
$5\frac{1}{2}$	—. 07
$6\frac{1}{2}$	—. 08
$7\frac{1}{2}$	—. 07
$8\frac{1}{2}$	—. 06
$9\frac{1}{2}$	—. 05
$10\frac{1}{2}$	—. 05
$11\frac{1}{2}$	—. 04

The correction furnished by the last two tables, and the corrected residual from the table, are given in Table No. 12, next following.

TABLE No. XII:

Showing residuals after correcting for new computations of ordinates, and difference between high water and maximum ordinates.

Time of moon's transit.	Correction of residual.	Residual.	Corrected residual.
Hours.	*Feet.*	*Feet.*	*Feet.*
$0\frac{1}{2}$	—.11	.22	.11
$1\frac{1}{2}$	—.02	.13	.11
$2\frac{1}{2}$	—.08	.15	.07
$3\frac{1}{2}$	—.12	.13	.01
$4\frac{1}{2}$	—.12	.08	—.04
$5\frac{1}{2}$	—.11	.02	—.08
$6\frac{1}{2}$	—.10	.01	—.08
$7\frac{1}{2}$	—.08	.03	—.05
$8\frac{1}{2}$	—.05	.08	.03
$9\frac{1}{2}$	—.09	.12	.03
$10\frac{1}{2}$	—.10	.11	.01
$11\frac{1}{2}$	—.07	.16	.09
			+.21
		Mean...	.017

Comparing the residuals in this table with the uncorrected ones, we find their magnitude much depressed; the average is now less than 0.02 of a foot; but the form of the series is, as before, that belonging to the semi-diurnal curve, and is as well marked as when the quantities were more considerable. Diagram No. 6 shows this fact; containing the curve of residuals from Tables 8 and 12, and of half-monthly inequality deduced from the observations. This persistence in the form of the residuals affords the best evidence that the irregularities of the observations, and changes in the mode of computation, do not introduce errors of sufficient magnitude to mark the laws of the phenomena. I propose, therefore, to modify the original hypothesis, so as if possible to obliterate this form in the residual.

Some collateral questions have been examined in the course of this discussion, the results of which are interesting. One of these is the comparison of the maximum ordinates of the diurnal curve, corresponding to the moon's declination north and south. The average value of the sine of twice the moon's declination, and the corresponding average maximum ordinate for northern and southern declinations, are shown in the next table; from which it appears that if the values of sin $2\delta'$ were equal, the heights would not differ appreciably.

TABLE No. XIII:

Showing the mean value of twice the moon's declination, and the corresponding maximum ordinates for northern and southern declinations.

Sine $2\delta'$.	Maximum ordinate.	Sine $2\delta'$.	Maximum ordinate.
.410	.621	.351	.538
		.410	.629

Another question was, whether the residuals, of which Table No. 7 shows a part, contained any portion which varied with the moon's declination. To test this, the residuals for six months were grouped, according to the declinations, with the following result:

TABLE No. XIV:

Containing the residuals after subtracting the terms containing the sine of twice the moon's declination, and the sine of twice the sun's declination, from the maximum ordinates, grouped according to the value of the sine of twice the moon's declination.

Average value of twice sine moon's declination.

Groups	0 to 20	20 to 35	35 to 45	45 to 55	55 to 70
Average value	.151	.147	.169	.115	.167
Number of observations	(33)	(27)	(26)	(44)	(37)

The result indicates that there is no such term remaining in the residual.

Another question was, as to whether changing the epoch would improve the results. Several attempts of this kind were made at different stages of the work, but without any marked advantage. The average result for the year, as shown by comparing the dates of occurrence of the greatest and least maximum ordinate of the diurnal curve, and the greatest and least values of the term containing the moon's declination, is shown in the next table. The comparison is made in two different ways—first, by the date of the greatest value of the ordinate shown in the table of maximum ordinates; and, secondly, by the date shown by the highest point of the curve, which was traced to represent the observations.

TABLE No. XV:

Showing results of comparison of dates of occurrence of the greatest and least maximum ordinate of the diurnal curve, and the greatest and least value of the term containing the moon's declination.

DATE OF OCCURRENCE: AVERAGE IN DAYS.

Maximum ordinate from table.	Maximum ordinate from curve.	Term embracing sun and moon's declination.	Minimum ordinate from table.	Minimum ordinate from curve.	Term containing sun and moon's declination.
15.4	16.1	16.0	16.5	16.6	16.0

The *times* of occurrence of the maximum of the diurnal curve are, as I have already stated, connected by the hypothesis with those of the semi-diurnal curve. The times deducible from the observations were so irregular, that I supposed it impracticable to do more than this. Notwithstanding all these irregularities, it turns out that the laws of the phenomena for the times are deducible from the results. The average values follow those for the semi-diurnal curve at the proper intervals. It will be practicable, therefore, to resume the examination of this part of the subject, which I accordingly purpose to do.

II.—SEMI-DIURNAL CURVE.

The results in relation to the semi-diurnal curve have exceeded my anticipations. The half-monthly inequality, both in height and time, is very well shown by the maximum ordinates deduced; though the greatest value of the height is only 0.22 foot, and the irregularities in the separate observed high waters fall upon hours instead of minutes. In the following table, the maximum ordinates obtained by the method of groups are

used, and the small corrections for the difference between maximum and high water ordinates are omitted. The table contains the time of the moon's transit corresponding to the observed height; and the height computed from the formula given by Mr. Lubbock as resulting from Bernouilli's theory, and the difference between observation and theory.

TABLE No. XVI:

Showing half-monthly inequality in height.

Hours of moon's transit.	Observed height.	Computed height.	O—C. Difference of observed and computed.
$0\frac{1}{2}$	.220	.223	—.003
$1\frac{1}{2}$	.196	.206	—.016
$2\frac{1}{2}$	.199	.174	.025
$3\frac{1}{2}$	.147	.131	.016
$4\frac{1}{2}$	.132	.087	.045
$5\frac{1}{2}$	.074	.056	.018
$6\frac{1}{2}$	.047	.056	—.009
$7\frac{1}{2}$	.074	.087	—.013
$8\frac{1}{2}$	.113	.131	—.018
$9\frac{1}{2}$	.135	.174	—.039
$10\frac{1}{2}$	.133	.206	—.073
$11\frac{1}{2}$	.189	.223	—.034

The greatest difference between observed and computed heights is 0.073, and the least difference 0.003; and the mean, without regard to sign, is 0.026. Diagram No. 8 shows the observed and computed curves of half-monthly inequality of heights. The average interval corresponds to $2^h\ 35^m$ of the moon's transit; which is, therefore, the zero point or epoch of the half-monthly inequality in the interval.

		h.	m.		h.	m.
The interval corresponding to the moon's transit at		3	30	is	11	45
"	for	9	30	"	13	05
				Difference is	1	20

which, converted into arc, is 20°.

$$\text{Log tan } 20° = \log (A) = 9.56107:$$

$$(A) = 0.364; \qquad \frac{1}{A} = 2.747;$$

which is nearly the same as that obtained by Mr. Lubbock for Liverpool. The difference between the greatest and least heights is

$$(0.220 - 0.047) = 0.173 \qquad E = \frac{0.173}{2(A)} = 0.238:$$

also the greatest height $0.220 = D + (E) \times (1 + A) = D + 0.325$; and $D = -0.10$.

Since $\frac{m'}{m' + M} = \frac{(0.07480)^2}{(A)} = \frac{1}{65.06'}$, $\frac{m'}{M} = \frac{1}{64.06}$.

For the half-monthly inequality of the intervals, we have

$$\text{tang } 2\psi = \frac{(A) \times \sin 2\varphi}{1 + (A) \times \cos 2\varphi} = \frac{0.364 \times \sin 2\varphi}{1 + 0.364 \times \cos 2\varphi};$$

and in the heights,

$$h = -0.10 + (E) \times (A) \times \cos(2\psi - 2\varphi) + (E) \cos 2\psi$$
$$= -1.10 + 0.087 \times \cos(2\psi - 2\varphi) + 0.238 \times \cos 2\psi,$$

The following table contains the half-monthly inequality of times deduced from the observations, and computed from the formula for tang 2ψ, and the comparison of observed and computed quantities:

TABLE No. XVII:

Showing differences between the results obtained from the observations and from formula.

Mean from observation 12. 35.

φ		C. From formula.	O. From observation.	O—C. +	O—C. −
h. m.	h. m.	h. m.	h. m.	m.	m.
0 30	0 08	12 27	12 31	04	
1 30	23	12 12	12 31	19	
2 30	36	11 59	11 19		40
3 30	42	11 53	11 45		08
4 30	38	11 57	12 03	06	
5 30	17	12 18	12 24	06	
6 30	17	12 52	12 38		14
7 30	38	13 13	13 09		04
8 30	42	13 17	13 27	10	
9 30	36	13 11	13 05		06
10 30	23	12 58	13 05	07	
11 30	08	12 43	13 05	22	
				+74	−72

$12^h\ 35^m$ not being the exact mean of the observed times, the + and − differences do not balance exactly.

Diagram No. 9 shows the observed and computed results. The greatest and least heights correspond with the average interval, as they should do by Bernouilli's theory. The mean luni-tidal interval corresponds to $0^h\ 23^m$, which shows that a change of epoch of one transit would have made the mean interval agree with the transit at 0 hours.

APPENDIX No. 23.

Letter from the Secretary of the Treasury to the Superintendent of the Coast Survey, in relation to the detail of brevet second lieutenants of the army for Coast Survey duty.

TREASURY DEPARTMENT,
December 4, 1852.

SIR: I transmit, herewith, a copy of the reply of the Secretary of War to the application made in your letter to this department, dated the 18th ultimo, respecting the detail of brevet second lieutenants of the army, graduates of the Military Academy, for duty on Coast Survey, as contemplated by the civil and diplomatic appropriation act, approved 31st August, 1852.

Very respectfully, your obedient servant,

WM. L. HODGE,
Acting Secretary of the Treasury.

Prof. A. D. BACHE, *Supt. Coast Survey.*

WAR DEPARTMENT, *December* 1, 1852.

SIR: I have received your letter of the 26th ultimo, requesting to be informed of the number of officers of the grade of brevet second lieutenant that can at this time be spared from the military service for duty on the Coast Survey.

In reply thereto, I have to inform you that the number of officers now on detached service is so great that there is not a single brevet second lieutenant for whom there is no command in the army; none, therefore, can be spared for duty on the Coast Survey except by relieving the officers of higher rank already engaged on that service, and replacing them by an equal or less number of brevet second lieutenants.

The number of officers now on the Survey above this grade is twelve.

Very respectfully, your obedient servant,

C. M. CONRAD, *Secretary of War.*

W. L. HODGE, Esq., *Acting Secretary of the Treasury.*

APPENDIX No. 24.

Extract from the report of Brevet Brig. Gen. Joseph G. Totten, Chief Engineer, to the Secretary of War, in relation to the assistance rendered by the parties and charts of the Coast Survey to the board of engineers projecting works for the defence of San Francisco bay.

ENGINEER DEPARTMENT,
August 12, 1852.

* * * * * *

That so much progress has been made in the preparations for these defences, collecting and placing in order the information necessary to the action of Congress, and removing all doubts as to practicability, is due, as I ought to state, to the zealous and untiring labors of the board; and also, and very much, to the hearty and efficient co-operation of the Superintendent and assistants of the Coast Survey. It is almost entirely on maps made by energetic parties acting under the particular instructions of the Superintendent of the Coast Survey, that the projects of defence for San Francisco bay have been framed.

And it may and *ought* to be said, that but for the copious and accurate information thus promptly supplied from that source, these plans of defence could not at this time, nor indeed for a considerable time to come, have been made ready to be carried into execution.

I have the honor to be, &c.,

JOSEPH G. TOTTEN,
Brevet Brigadier General.

APPENDIX No. 25.

Correspondence of Assistant R. D. Cutts with the Secretary of the Commission for locating the naval depot at San Francisco.

U. S. SCHOONER BALTIMORE,
Columbia River, August 8, 1852.

DEAR SIR: I have duly received your letters of June 8th and 17th, numbered 12, 13, and 14.

With respect to the Commission for locating a naval depot, the enclosed correspondence will explain all that has occurred.

The secretary was directed to write me a letter of thanks; but it was either forgotten, or, if written, never received, as I left San Francisco a day or two after the desired information was given. I may add that I offered verbally to make any surveys, &c., that would assist in the accomplishment of the object of the Commission.

I am, very truly, yours,

RICHARD D. CUTTS.

Prof. A. D. BACHE, *Supt. U. S. Coast Survey.*

U. S. BRIG MAJOR EASTLAND,
San Francisco Bay, Cal., May 25, 1852.

DEAR SIR: I have been directed by the board to apply to you for such information which you possess as will facilitate the examination of the bay for the location of a naval depot.

We have already in our possession a copy of a chart, in part executed by you, of Mare island and straits. I mention this by way of sparing unnecessary trouble.

The following points may be suggested:

1. Your points of triangulation and their distances, if not on a projection, and the azimuthal angle.
2. Tracings of the shore-line in the bay, if you have any.
3. If your distances are in metres, the value of a metre in inches and decimals.
4. Such other information or suggestions as in your experience and good judgment may occur to you as calculated to aid us.

Very truly, yours,

DANIEL AMMEN, *Secretary to the Board.*

R. D. CUTTS, Esq.,
Assistant U. S. Coast Survey.

U. S. SCHOONER BALTIMORE,
San Francisco Bay, May 28, 1852.

DEAR SIR: I have received your note of the 25th, requesting, on the part of the board of commissioners for the location of a naval depot, such data as I may possess that would tend to facilitate their examinations, and I take great pleasure in complying with the request.

I send you, herewith, the following tracings of surveys, &c., made by the party under my charge for the survey of the coast:

1. Sketch of the triangulation of San Francisco bay.
2. Cahier, containing the distances between the different signals, expressed in metres, with the value of the metre in American standard inches; also, the azimuth of different lines.
3. Survey of Sancelito.
4. Survey of Raccoon straits.
5. Survey of South San Francisco.
6. Survey of the shore from Rincon Point to Point Avisadera.

With respect to any other information or suggestions from me, I can offer none that will not be better and more fully acquired by the detailed examinations proposed by the board.

I am, very truly, yours,

RICHARD D. CUTTS.

DANIEL AMMEN, *Lieut. U. S. N.,*
Secretary to the Board, &c.

APPENDIX No. 26.

Letter of Commodore M. C. Perry, U. S. Navy, to Major Stevens, assistant in charge of Coast Survey Office, acknowledging the receipt of articles sent by the Coast Survey to the government of Japan.

NAVY DEPARTMENT,
Washington, November 2, 1852.

MY DEAR SIR: I have the pleasure of acknowledging the receipt of your communications of the 20th and 23d ultimo.

The packages therein mentioned have been sent to the steamer Princeton, and I beg to tender to yourself and Professor Bache many thanks for the trouble you have taken in furnishing so many valuable articles for the service in which I am about to embark.

With great respect, I am, dear sir, very truly yours,

M. C. PERRY.

Major STEVENS, *U. S. A., Coast Survey.*

APPENDIX No. 27.

Letter from Major W. H. Chase, U. S. Corps of Engineers, to the Superintendent, in relation to information furnished by the Coast Survey in regard to Dog River bar and Choctaw Pass, Alabama.

NOVEMBER 11, 1852.

MY DEAR SIR: I received your letter of the 30th October, under an envelope from the Chief Engineer. The tracing of a survey of Dog River bar and Choctaw Pass, near Mobile, was also duly received.

I beg to make my acknowledgments for your official attention in the case.

The information furnished will make my labors easy in organizing the means for improving the harbor of Mobile. It will also save to the government several hundred dollars that otherwise would have been required to be expended in making surveys which are now so promptly furnished.

Independent of the main object to be effected by your great and good work, other advantages are incidentally afforded to the public interest, not the least among which are the intimate relations with the light-house department, the initiative of which you took some two or three years back. The good that will come of this is worth all the money expended on the Coast Survey since you have had charge of it.

Another incidental advantage is the abundant information afforded to the river and harbor improvements, by accurate surveys of a great many of the localities.

Permit me to add, that the work of the Coast Survey and the improvement of harbors and dependent rivers, in connexion with railroads, are elements of defence naturally, to which, until very lately, sufficient importance has not been attached.

I trust that these elements, when once understood, will be strong enough to sustain to the end the Coast Survey, and a system of improvement by the general government, having in view the support of commerce and the advancement of the national defence.

I have the honor to be, dear sir, respectfully and truly, your friend and servant,

WM. H. CHASE.

A. D. BACHE, LL. D.,
Superintendent Coast Survey, Washington.

APPENDIX No. 27, *bis*.

Correspondence between S. W. Comstock, Esq., Vice President of the Pacific Mail Steamship Company, and Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey, in relation to assistance rendered by the latter to the steamship California, disabled at San Pedro.

OFFICE PACIFIC M. S. Co.,
San Francisco, May 8, 1852.

DEAR SIR: The pressure of business, and anxiety consequent on the despatch of the steamship "Unicorn" to the relief of the passengers and steamship "California," disabled at San Pedro, have prevented my acknowledging at an earlier period the very important service yourself and command have rendered the Pacific Mail Steamship Company, and the public, in bringing the mails from San Pedro.

Your prompt and very generous aid has been reported to the Home Office, and the president of the company will no doubt be most happy, also, to acknowledge the obligation which all must feel you have placed us under in preventing the inconvenience resulting from delay of the mails, and in enabling the company so speedily to remedy the disaster.

In the same cordial feeling which prompted you, allow me to offer my thanks, and to assure you that should circumstances ever place it in my power, I shall be most happy to reciprocate.

Very truly yours,

SAMUEL W. COMSTOCK, *Vice President.*

Lieut. JAMES ALDEN,
Commander U. S. Steamer Active.

U. S. STEAMER ACTIVE,
San Francisco, May 10, 1852.

DEAR SIR: Your note of the 8th inst. was duly received, and its contents have been communicated to the officers under my command.

We all appreciate your generous acknowledgment of our endeavors to remedy the evil so disastrous to the company which you represent, and would assure you that it is not only an agreeable duty, but a pleasure, always to lend a helping hand to those who may stand in need of it.

Very truly yours,

JAMES ALDEN, *Lt. Commanding.*

SAMUEL W. COMSTOCK, Esq.,
Vice President P. M. S. Company.

APPENDIX No. 28.

Letter from John C. Hoyt, Esq., of Key West, Florida, to the Superintendent, enclosing a list of vessels lost or ashore on the Florida reef, from November 1, 1851, *to November* 1, 1852.

KEY WEST, *November* 8, 1852.

SIR: At the request of F. H. Gerdes, Esq., of U. S. Coast Survey, I enclose you a list of vessels that have been lost or ashore on the Florida reef, from the 1st November,

1851, to the 1st November, 1852, together with amount of salvage awarded, amount of salvage and expenses on vessel and cargo, and the value of vessel and cargo, as near as could be ascertained here.

During the above time a number of vessels have been ashore on the Florida reef, and got off without assistance, and I have no record of them.

I am, very respectfully, your obedient servant,

JOHN C. HOYT.

ALEX. D. BACHE, Esq.,
Superintendent U. S. Coast Survey, Washington.

List of wrecks on the Florida Reef, from November 1, 1851, *to November* 1, 1852.

Date.	Name of vessel.	Where from.	Where bound.	Amount of salvage.	Amount of salvage and expenses.	Value of vessel and cargo.	Remarks.
1851.							
November.	Schooner S. Jackson.	Philadelphia.	Mobile.....	.....	$400	$25,000	Loss of sails, &c.
Do	Ship John and Albert.	New York ..	New Orleans.	$6,000	8,000	28,000	Ashore on Pelican reef; cargo, hay.
Do	Ship I. Newton.....	Charleston..	.... do.....	.....	.....	20,000	Ashore, and got off without assistance.
Do	Ship J. Conner.....	Liverpool...	.... do.....	100	100	40,000	Ashore on American shoals.
December.	Schooner Merchant..	Charleston..	Havana	900	1,200	15,000	Lost near Cape Florida.
Do	Barque J. Stroud....	New York ..	St. Mark's...	.....	2,100	15,000	Ashore, and got off without assistance.
Do	Brig Mechanic	Savannah ...	New Orleans.	2,875	6,000	12,000	Ashore on Carysfort reef.
Do	Brig Persia	Cuba.....	Boston.....	800	1,600	12,000	Lost on Carysfort reef.
1852.							
January ..	Ship Telamon.....	New York ..	New Orleans.	14,300	20,000	120,000	Lost near Key Vacas.
February..	Barque Franklin	Appalachi'la.	New York ...	8,400	10,700	35,000	Ashore at Tortugas.
June	Barque Nacoochee ..	Galveston ..	Boston.....	7,940	12,000	24,000	Ashore at Pickle's reef.
July	Barque M. Van Beel.	Matanzas ...	Cowes	7,200	15,500	60,000	Lost on Carysfort reef.
Do	Brig Charlotte	Cuba.....	St. John's ...	1,500	2,000	5,500	Ashore at French reef; in ballast.
August ...	Barque Empress.....	Havana	Boston.....	7,500	9,500	34,000	Ashore at Key Vacas.
Do	Barque Jasper	...do.....	New York ...	8,000	15,000	20,000	Ashore at Boca Chica.
Do	Brig Sarah	Cuba.....	Nova Scotia .	2,850	5,600	15,000	Lost at New Found Harbor.
Do	Brig Brownsville	New York ..	Texas	17,000	25,000	75,000	Ashore at Tortugas.
				85,365	134,700	555,500	

KEY WEST, *November* 1, 1852.

JOHN C. HOYT, *Agent for Underwriters.*

APPENDIX No. 29.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, in reply to the resolution of the U. S. Senate, in relation to the reconnaissance of the coast of California, from San Diego to Cape St. Lucas.

COAST SURVEY OFFICE, *August* 18, 1852.

SIR: I have the honor to acknowledge the receipt of yours of August 18th, requesting a report in relation to the accompanying resolution of the Senate of the United States. The resolution is as follows:

"*Resolved*, That the Secretary of the Treasury be requested to inform the Senate whether, without interfering with the progress of the Coast Survey, the reconnaissance of the coast of California may be extended south to Cape St. Lucas."

A preliminary reconnaissance of the Western Coast has been made by the parties of the Coast Survey, from the entrance of Columbia river, south, to San Diego; and they are now engaged in extending it northward to the boundary of Oregon. When they pass south again in the season, to fill up the details of the work, towards San Diego, it will be easy to extend the reconnaissance to Cape St. Lucas, if authority is given by Congress so to do. The parties on the western coast are now provided with the desired facilities for working—instruments, means of transportation, and equipments, including a steam-vessel adapted to surveying purposes, in charge of the hydrographic party. They are thus prepared to do this work without any additional cost for expensive outfits. If carried on in connexion with the present operations, it may be executed in a reasonable time, without additional or special appropriations for the object. The intention of the British surveyors to carry their work from the Russian possessions southward to Oregon, and from the coast of Guatemala northward to Cape St. Lucas, is shown in a letter addressed by Captain Watkins to W. H. Aspinwall, Esq., president of the Pacific Mail Steamship Company, hereto annexed, (marked No. 1.) The filling up of the gap between Cape St. Lucas and San Diego will give a connected chart of the most important part of the western coast of North America.

Detached surveys of harbors, and general examinations of parts of this coast, have been made from time to time by Great Britain, France, and the United States, without objection from the government of Mexico, which is not itself engaged in any such work.

The portion of the coast embraced in the resolution of the Senate is in the direct track of our commerce and mail communication with our Pacific coast. This has caused attention to be called to the subject by the officers of the Pacific Mail Steamship Company, and by other citizens of California; and I have reason to know they have only been withheld from expressing strong wishes on the subject by the desire to permit first the execution of the general reconnaissance of the coast within our limits, now nearly completed, in a preliminary way.

A letter stating the importance of such a survey was received recently from Assistant Richard D. Cutts, who has been successfully engaged for the last two years in the operations of the survey of that coast. As it contains facts and reasonings directly to the point of the resolution, I have the honor to refer to extracts appended to this, and numbered 2. Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey, in charge of the hydrographic party on the Pacific, has also directed attention to the same subject, and states in a recent letter that "there seems to be a strong feeling at San Francisco in favor of our extending our reconnaissance as far at least as Cape St. Lucas, Lower California. He also transmits the letter, before referred to, (No. 1,) of Captain Watkins, of the mail steamer Panama. Captain Watkins says of the survey: "It is unquestionably of the first importance to our whole marine engaged in the North Pacific, for at this moment there is not a chart published, that I am aware of, on which we can place dependence; many of the headlands and islands are from twenty to forty miles out of the way."

In view, then, of the importance of this work to the commerce of our country, and of its connexion with our own coast-work—which renders a reconnaissance easy, with the facilities already provided for the Coast Survey on the Pacific—I do not hesitate to say to the department that the reconnaissance of the coast of California may be extended south to Cape St. Lucas without interfering with the regular progress of the Coast Survey, and without requiring a special appropriation, but simply the authority of Congress so to extend our operations.

Respectfully submitted, by A. D. BACHE, *Superintendent.*

Hon. THOS. CORWIN, *Secretary of the Treasury.*

[No. 1.]—*Copy of a letter from Captain Watkins, of the U. S. mail steamship Panama, to Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey.*

STEAMER PANAMA, *Benicia, July* 8, 1852.

DEAR SIR: It having been out of my power sooner to comply with your request, I now take pleasure in forwarding the following extract of my letter to Wm. H. Aspinwall, Esq., president Pacific Mail Steamship Company:

"I beg leave to call your particular attention to the extending of our coast survey from San Diego at least as far as Cape St. Lucas, Lower California. It is unquestionably of the first importance to our whole marine engaged in the North Pacific, for at this moment there is not a chart published, that I am aware of, on which we can place dependence; many of the headlands and islands are from twenty to forty miles out of the way. The English government surveyors are coming up slowly from Panama, and are now on the coast of Guatemala, carrying on elaborate surveys, and it is their intention to connect their whole line of surveys as far north as the Gulf of California. I here copy you an extract from a return made to the House of Commons, from the Hydrographic Department of the Admiralty, in reference to the coast of California and Oregon: 'On the opposite side of the Pacific some progress has been made in surveying the coast between the Russian territory and the Straits of Juan de Fuca; but, with the long interval between the Oregon district and the entrance of the Gulf of California we are very superficially acquainted, and but little is known of that extensive Gulf. In the present state of the countries it does not appear necessary to push our surveys into their inner waters, but there can be no doubt that the coast of Mexico, Guatemala, and New Grenada, which contains many valuable harbors and trading ports, ought to be minutely and correctly surveyed.'

"Since this report was made, the true positions of all the headlands and islands from Cape St. Lucas to Vancouver's island have been determined by Captain Kellett, in H. M. surveying brig Herald. If our government is in possession of these positions, I am not aware of it. With all of our enormous trade to Oregon, Upper and Lower California, and along the coast of Mexico, Guatemala, and New Grenada, we have not a light-house or beacon of any kind, and from San Diego to Panama we have not a correct coast chart. We have nearly all the harbor charts, correctly surveyed by the English officers. I cannot for a moment suppose that it can be from any narrow policy, but from the want of information, that our government withholds that protection to her commerce which it so much needs and justly expects. She has all the material now in California, so that the expense of extending our line of coast survey, if only to Cape St. Lucas, would be but trifling and could be accomplished in a few months."

Yours, truly, JAS. WATKINS.

[No. 2.]—*Extracts from a letter of Richard D. Cutts, Esq., assistant U. S. Coast Survey, to the Superintendent, dated April* 4, 1852.

U. S. SURVEYING SCHOONER BALTIMORE,
San Francisco Bay.

DEAR SIR: I am not aware that a reconnaissance of the coast from San Diego southward to Panama has as yet attracted the attention of the government. The necessity for such a survey is becoming every day more evident, and will soon be emphatically called for by the people of this State. As an assistant in the survey of the coast, I have frequently been spoken to on this subject, and have been asked why the government does not have this great route surveyed? * * * * * * *

In reference, however, to the particular route from Panama to the southern boundary of California, its reconnaissance will soon become a national necessity.

The value and importance of these surveys are not thoroughly understood by the people at large. The advantage of an accurate chart, though its influence be unknown by all but the sailor, the merchant, and the insurance company, is yet felt through all the machinery of a commercial nation. I have no doubt, therefore, but that sooner or later Congress will authorize the survey; and should that be the case, you are so much better prepared than any other department, in personnel and vessels on this coast, and in order, system, and economy, for its execution, that I determined to write you on the subject, although doubtless it must have heretofore engaged your attention.

The statistics showing the value of the trade, as it at present exists, coasting along from Panama to the American territory, can be as well obtained in Washington as here. The *future* value and importance of that trade cannot be understood or estimated but by intelligent persons, who have travelled through California, and who are capable of forming a correct judgment of its resources and future destiny. Along this same route nearly half a million of American citizens, either in coming or returning, will have travelled before the end of the year, and it will ever continue the highway of this country. I have no doubt in my own mind that one-twentieth of the entire population of the United States will have visited California before Congress will have ordered the survey of the route by which they are to travel. I hope this may not be so. Certainly no individual or company should undertake it. The work should be the work of a nation, so that the results should command from all implicit confidence.

With the existing charts of that coast you are well acquainted, and know how much confidence can be placed in them. The English have made some surveys, but they are unconnected, and thus deficient in the most important element. I understand that the English government expects us now to do our share. It may be stated that the inaccuracy of the charts is the cause of great anxiety to the captains and owners of the steamships and other vessels plying on this coast, and that they are about to present a memorial to Congress on the subject. There are very few of the captains who cannot recount some hairbreadth escapes;—some have been ashore;—and all this risk due to the fact that this headland, or that bay, is thirty or forty miles distant from the position assigned it on the chart. Existing rocks and islands are not down at all, and some far distant from the coast-line. Indeed, it is the practice of some of the best sailors to keep in sight of land or hug the coast, rather than trust to a straight course taken off from the present charts. Many interesting details might be mentioned in corroboration of the above, but they are not necessary in this letter.

The reconnaissance of the coast from San Francisco to San Diego, five hundred miles or thereabouts, may be adopted as a standard by which to compute the time and expense the extension of the survey to Panama would cost the government. That reconnaissance you are now about to publish. The expense to the government would not be equal to the mere fitting out of a party on the Atlantic seaboard, should any other department undertake the duty. The party that made the above mentioned reconnaissance, with a slight addition to its organization, would make a chart in which the utmost reliance could be placed. At the commencement of 1853, the "Active" might be made available for that work. The details of the organization and style of survey, and the times with respect to climate and locality, you could readily arrange, and the system of the survey would produce results of the best character, long before other departments could get started.

Commerce merely requires a Coast Survey reconnaissance of that route. The elaborate surveys based upon geodetic operations would be confined, as in all other countries, to our own coasts.

* * * * * * * * * *

APPENDIX No. 30.

Resolutions adopted at a meeting of officers of the Coast Survey in relation to the decease of Assistant John B. Glück.

At a meeting on the 12th of February, at 1 o'clock, of the officers of the U. S. Coast Survey present in Washington, the Superintendent of the work, Professor A. D. Bache, was called to the chair.

Lieut. Almy, of the U. S. navy, stated that the object of the meeting was to pay a tribute of respect to the memory of our late associate and friend John B. Glück, assistant in the U. S. Coast Survey. For that purpose he submitted the following resolutions, which were (after remarks on the character and services of Mr. Glück by Professor Bache) unanimously adopted:

Resolved, That we have learned with sincere sorrow the decease of our friend and comrade, John B. Glück, assistant in the Coast Survey, whose manly and amiable character endeared him to us, while his professional zeal and ability commanded our respect; that we deeply sympathize with his bereaved and sorrowing family in a loss that we will not by words presume to measure or describe. As a tribute, however, of sincere condolence with them, and of our respect for the departed, we would offer this manifestation of our feelings, and at the same time commend them to Him who careth for the desolate and afflicted.

Resolved, That Lieut. J. J. Almy, U. S. Navy; Major Isaac I. Stevens, U. S. Army; Samuel Hein, Esq.; Lieut. Thornton A. Jenkins, U. S. Navy; and William S. Walker, Esq., be a committee to communicate these resolutions to the family of Mr. Glück, in Baltimore and in Germany, and for publication in the newspapers of Washington and Baltimore.

A. D. BACHE, *Chairman.*

APPENDIX No. 30 *bis.*

Resolutions in relation to the decease of Assistant J. B. Glück, by the officers employed on the Gulf of Mexico, his former associates.

CEDAR KEYS, FLORIDA, *March* 1, 1852.

The assistants and others attached to the U. S. Coast Survey, stationed on the Gulf of Mexico, having been informed of the deplorable death of our associate and friend John B. Glück, assistant of the Coast Survey, it becomes our melancholy duty to express our grief, not only for the loss of an able and skilful officer to his department, but also for the loss to ourselves of an intimate and dear friend of many years' acquaintance—of an upright, gentlemanly, and amiable man, who was beloved by all who knew his virtues and high social qualities: And it is therefore

Resolved, To wear the usual badge of mourning for the space of thirty days.

2. To send copies of this to the family of the deceased, as a testimonial of our respectful and sincere condolence in their bereavement.

3. To have the above resolutions printed in the Washington and Baltimore papers.

F. H. GERDES,

In behalf of Assistants and others of the Coast Survey on the Gulf of Mexico.

APPENDIX No. 31.

Resolutions in relation to the decease of Assistant Woods Baker, adopted by the officers of the Coast Survey on duty in Section I.

CAPE SMALL POINT, *September* 30, 1852.

The undersigned, officers of the Coast Survey now on duty in this section, having received intelligence of the sudden and distressing death of their friend and associate, Woods Baker, assistant in the Coast Survey, desire to unite in expressing their deep sorrow for his loss, and in giving their willing testimony in praise of his many virtues; and do therefore

Resolve, That in our dear friend we have lost a noble, high-minded, and generous spirit, whose purity of character, gentle and amiable manners, disinterested friendship, and warm sympathies, won our highest esteem.

That we feel deeply his loss as an associate in the public service, where his high attainments and his unceasing industry, guided by the most conscientious adherence to his duty, marked him as one of the most useful of the officers of the Survey, and gave promise of elevating him to the highest station among scientific men.

That to his family and friends, who are called upon to bear the greatest weight of this sudden affliction, we desire respectfully to offer our most sincere sympathies: we feel that as, next to them, we could best appreciate his virtues, so, next to them, his loss bears heaviest on our hearts.

That we will wear the usual badge of mourning for thirty days.

That a copy of these resolutions be transmitted to his family, and that they be also published.

A. D. BACHE.
W. P. TROWBRIDGE.
CHARLES O. BOUTELLE.
GEORGE A. FAIRFIELD.
GEORGE W. DEAN.
P. B. HOOE.
HUGH McHENRY.
THOMAS McDONNELL.

APPENDIX No. 32.

Resolutions in relation to the decease of Assistant Joseph S. Ruth, adopted by the officers employed on the Pacific coast.

At a meeting of civilians and officers of the navy, attached to the Coast Survey on the Pacific coast, assembled on board the U. S. surveying schooner Baltimore, for the purpose of paying the last tribute of respect to the memory of Jos. S. Ruth, assistant in the Survey, who, while engaged in the duties appertaining to his position, was drowned in the Columbia river on the 17th of October, on motion of Lieut. Comg. James Alden, U. S. Navy, R. D. Cutts, Esq., was appointed president, and George Davidson, Esq., secretary.

The following resolutions were adopted:

Resolved, That we have received with deep emotion the melancholy intelligence of the death of Jos. S. Ruth, and that we sincerely mourn the sudden and melancholy fate of an associate, loved and respected by all, and doubly endeared to many of us by long years of companionship.

Resolved, That by the death of Joseph S. Ruth, the Survey has lost one of its most able and accomplished members.

Resolved, That we most sincerely sympathize with the widowed mother of the deceased, who by this sudden dispensation of Providence has been bereaved of an affectionate and devoted son.

Resolved, That a copy of these resolutions be transmitted to the mother of the deceased, to Prof. A. D. Bache, Superintendent U. S. Coast Survey, and also that they be published.

RICHARD D. CUTTS, *President.*
GEORGE DAVIDSON, *Secretary.*

APPENDIX No. 33.

Letter of the Secretary of the Treasury to the Superintendent of the Coast Survey, directing examinations of sites for light-houses, beacons, buoys, &c., in accordance with the recommendation of the Light-house Board, and the Superintendent's reply thereto.

TREASURY DEPARTMENT, *September* 24, 1852.

SIR: The Light-house Board, to which was referred the duty of reporting to the department upon the necessity of preliminary surveys, as required by the 5th section of "An act making appropriations for light-houses, light-boats, buoys, &c., and providing for the erection and establishment of the same, and for other purposes," approved 31st August, 1852, has made a report, of which the enclosed is a copy, designating several points at which it recommends the necessity of preliminary surveys; and the duty of performing this service having been committed to you by the terms of said 5th section, you are respectfully instructed to enter upon it with the least avoidable delay, and report to the department as required by the 6th section of said act.

Very respectfully, your obedient servant,

W. L. HODGE, *Acting Secretary of the Treasury.*

Prof. A. D. BACHE, *Superintendent U. S. Coast Survey.*

OFFICE LIGHT-HOUSE BOARD,
Washington City, September 13, 1852.

SIR: In reply to your communication of the 9th instant, the board respectfully recommend that preliminary surveys may be made to determine the sites of the following aids to navigation which are authorized by the act making appropriations for light-houses, &c. &c., approved 31st August, 1852:

ON THE SEABOARD.

Maine.

For a light-house at the easterly end of a thoroughfare between North Haven and Vinal Haven, or on Herring Neck.

For the erection of a harbor-light on a point of land lying west of the entrance of Buck's harbor, in Brooksville.

For the erection of beacons, buoys, and spindles between Owl's Head and Whitehead light-houses, and through Muscle Ridge channel.

Massachusetts.

For a light-boat near Succonesset shoal, north channel Vineyard sound.

For a light-boat near Killpond bar, or a light-house in the vicinity of it.

New Jersey.

For a beacon to be placed on the shoal in Newark bay, known as the West Oyster Bed.

Virginia.

For a light-boat at Pungoteague creek, or a light-house to be built on a point of land adjoining said creek, as shall be found most expedient on examination.

For a light-house at Jones' Point, on the Potomac river, near Alexandria.

South Carolina.

For a bell-boat to be moored at Cape Roman shoal.

For two beacons or range-lights on South Island Point, and one beacon or range light on North island, to range with the main light at Georgetown harbor.

Mississippi.

For the erection of a light-house at or near the entrance of East Pascagoula river.

Louisiana.

For the examination and survey of Ship shoal and Raccoon Point, on the coast of Louisiana, with reference to the location and erection of a light-house and procuring a plan for the same.

Texas.

For a light-boat to be moored at Aransas Pass, or a light-house, as may be deemed most expedient upon a further examination.

California.

For the erection of a light-house at Santa Cruz.

* * * * * * * * * *

Very respectfully, your obedient servant,

W. BRANFORD SHUBRICK,
President Light-house Board.

Hon. W. L. HODGE,
Acting Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, ME.,
September 28, 1852.

SIR: I have the honor to acknowledge the receipt of the letter of the department of the 24th instant, instructing me to perform the duty of making certain preliminary surveys required by the 5th section of "An act making appropriations for light-houses, light-boats, buoys, &c., and providing for the erection and establishment of the same, and for other purposes," and recommended in an enclosed letter by the Light-house Board, to whom the duty of determining the necessity for such surveys was referred.

In reply, I have the honor to inform the department that these surveys shall be made by the officers of the hydrographic parties of the Coast Survey, when they visit the sections in which these localities lie, and that reports of their examinations shall be furnished to the de artment as soon as they are made.

Yours, respectfully, &c.,

A. D. BACHE, *Superintendent.*

Hon. W. L. HODGE,
Acting Secretary of the Treasury.

APPENDIX No. 34.

Table showing the results of examinations for sites of light-houses, beacons, buoys, &c., referred to the Superintendent of the Coast Survey by the Secretary of the Treasury, in accordance with the recommendation of the Light-house Board.

Section.	State.	No.	Special locality.	Object.	By whom examined.	Report of Superintendent.
I	Maine	1	Easterly end of thoroughfare between North Haven and Vinal Haven, or on Herring Neck.	Light-house	Lieut. Comg. Woodhull	Recommended Oct. 26, 1852.
		2	Point west of entrance of Buck's harbor, Brookville	Harbor light	do	do.
		3	Between Owl's Head and Whitehead light-houses, and through Muscle Ridge channel.	Beacons, buoys, or spindles.	do	do.
	Massachusetts	4	Succonesset shoal, North channel Vineyard sound	Light-boat	Lieut Comg. McBlair	do. Jan. 4, 1853.
		5	Killpond bar	Light-boat, or house	do	do.
II	New Jersey	6	Shoal in Newark bay, known as West Oyster Bed	Beacon	Lieut. M. Hunt	do. Oct. 25, 1852.
III	Virginia	7	Puncoteague creek	Light-boat, or house	Lieut. Comg. Almy	do. Nov. 24, 1852.
		8	Jones' Point, Potomac river	Light-house	Lieut. W. B. Whiting	do. Oct. 25, 1852.
IV	South Carolina	9	Cape Roman shoals	Bell-boat	Lieut. Comg. Craven	do. Nov. 30, 1852.

APPENDIX No. 34 *bis*.

Table of examinations of sites for light-houses, beacons, buoys, &c., referred to the Superintendent of the Coast Survey by the Treasury Department, in accordance with the recommendation of the Light-house Board, yet to be made, and for which instructions have been given.

Section.	State.	No.	Special locality.	Object.	To whom referred for examination.
VIII	Mississippi	1	Entrance of East Pascagoula river	Light-house	Lieut. Comg. B. F. Sands.
		2	Horn Island Pass	Three spar-buoys	do. do.
	Louisiana	3	Ship shoal and Raccoon Point	Examination and survey for light-house	Assistant F. H. Gerdes and Lieut. Comg. B. F. Sands.
X	California	4	Santa Cruz	Light-house	Lieut. Comg. James Alden.

APPENDIX No. 35.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, enclosing extracts from the report of Lieut. Comg. Woodhull, U. S. Navy, assistant in the Coast Survey, of examinations into the necessity of a light-house at Herring Neck, of harbor-lights at Condon Point or Pumpkin Island, and of beacons, buoys, &c., at other points on the coast of Maine.

COAST SURVEY OFFICE, *October* 26, 1852.

SIR: I have the honor to communicate to the department, to be transmitted to the Light-house Board, a copy of the instructions to Lieut. Comg. Maxwell Woodhull, U. S. Navy, assistant in the Coast Survey, and an extract from his report in relation to the following objects, for which examinations were required by the board. I concur in the recommendations of Lieut. Woodhull.

1. A light-house at the easterly end, &c.: Recommends to be placed on Herring Neck.

2. For the erection of a harbor-light, &c.: A light is recommended on the point of Pumpkin island, instead of on Condon Point. The board will judge whether the appropriation is, by the terms of the law, available for this purpose.

3. For the erection of beacons, &c.:

Six spindles, an iron tripod, one beacon, a bell-buoy, two can-buoys, and two spar-buoys, are recommended, and their positions designated. Should the appropriation not suffice for all these objects, their relative importance is stated by Lieut. Woodhull.

A fog-whistle at Whitehead light-house is recommended, in connexion with these objects, but is not among the items of appropriation. In the same class of objects not appropriated are two spar-buoys recommended to be placed near Owl's Head.

The attention of the board is called to the remarks of Lieut. Comg. Woodhull on the buoys in Penobscot bay, and the light-house at Eagle island and at Whitehead.

Very respectfully yours,

A. D. BACHE, *Superintendent.*

Hon. THOS. CORWIN,
Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, MAINE,
September 29, 1852.

SIR: Please, before the close of the surveying season, to make an examination and report of the necessity of the following light-houses, beacons, and buoys, appropriated for by act of Congress of August 31, 1852, and in regard to which preliminary examinations are required by the Light-house Board. Should the objects be recommended, a preliminary survey or reconnaissance is desirable, to show their locations and advantages.

These objects are:

1st. A light-house at the easterly end of a thoroughfare between North Haven and Vinal Haven, or on Herring Neck, Maine.

2d. For the erection of a harbor-light on a point of land lying west of the entrance of Buck's harbor, in Brooksville, Maine.

3d. For the erection of beacons, buoys, and spindles between Owl's Head and Whitehead light-houses, and through Muscle Ridge channel. (Amount appropriated $4,000.)

In the latter case (3d) you will specify the number of beacons, buoys, and spindles required, and whether the appropriation is in your judgment adequate, and the relative importance of the different objects.

To enable you more fully to understand the scope of this duty, I refer you to the instructions and reports made for the same ends last year, and to the 6th section of the appropriation bill, a copy of which is enclosed.

It is desirable to have your report as early as consistent with the discharge of the Coast Survey duties.

Yours respectfully,

A. D. BACHE, *Superintendent.*

Lieut. Comg. MAXWELL WOODHULL,
U. S. Navy, Assistant U. S. Coast Survey.

U. S. SCHOONER MADISON,
Portland, October 11, 1852.

SIR: I have the honor to report the result of my examinations, and the selections of the localities for the proposed light-houses, buoys, beacons, and spindles, agreeably to your order of the 29th September, between Owl's Head and Whitehead lights, at Buck's harbor, and at Vinal Haven, South Fox island.

I proceeded to Rockland, a fine, flourishing town about four miles to the northward of Owl's Head, where I was fortunate in obtaining the advice and assistance of two of the best pilots on the Penobscot, and a conveyance for the examination of the Muscle Ridge channel. I commenced at Owl's Head light, and proceeded on the sailing-courses to Whitehead.

For a better understanding of the subject, I shall give the correct courses through the channel, and the obstructions as they are met with. I will premise by saying that there is no place I am acquainted with requiring more the aids proposed than this thoroughfare, being the great highway for nearly the whole commerce of this great bay and river. I am informed by the deputy collector of the port of Rockland, that for nine months in the year, on an average, at least two thousand vessels of different rates use this channel monthly; besides, six steamers ply through it, making from three to four passages weekly, night and day. The names of the steamers are as follows: the Governor, the Boston, Admiral, Creole, Eastern State, and the Seacore. The trade of Rockland, as a specimen of the importance of the commerce of this river, is one million and a half dollars in the articles of lime and granite. The whole value of the coasting trade can be estimated from this one fact, and cannot be short of thirty millions, which is as likely to be under as above the mark. Besides the vessels that pass through the channel and up the bay, a large number use it partially in making an inland passage to the eastward, which is not included in the above estimate.

Beginning at Owl's Head light-house, and running the course SW. ½ S. to Sleeper's Point; the following obstacles are met with:

No. 1. Owl's Head ledge, situated about one hundred yards to the eastward of the light: a most dangerous rock, and immediately in the course to Rockland; it stands about three feet out of water at low tide. I recommend a spindle to be placed on it.

No. 2. Webb's Point: Equally as dangerous an obstacle as the above; the ledge is about two feet under water at high tide. I propose a spindle for this ledge.

No. 3. Ship Island bar, on the port hand at the SW. extremity of Ship island. Many vessels have been lost on this bar during the thick foggy weather; it is about three feet under water at low tide. I recommend a can-buoy to be placed on it.

Course from Sleeper's Point to Ash island, SSW.

No. 4. Eastern extremity of Ash Island Point, on the starboard hand. This point is much in the way (being a turning point) in the channel, and is the cause of much anxiety in beating through the passage. I would recommend a beacon to be placed on it, similar to the red one in Portsmouth harbor, constructed of wood, with a good elevation, and a distinctive mark on it.

No. 5. A spar-buoy on the south end of Ash island, starboard side.

Course from Ash island to Spruce Point, SW. $\frac{1}{2}$ S.

No. 6. Gangway ledge, nearly mid-channel on the starboard hand: a most dangerous impediment, about three feet under water at low tide. I recommend a can-buoy to be placed on it.

No. 7. Otter Island ledge, on starboard hand: has on it about two feet water at high tide; much in the way of navigation; a number of vessels have brought up on it. I recommend a spindle to be placed on it, with a good distinctive mark.

Course from Spruce Head Point to the Yellow ledges, SW. $\frac{1}{2}$ W.

No. 8. Haycock: a small ledge on the port hand, about one foot out of water at low tide. I think a small spindle would be useful.

No. 9. Garden Island ledge, on the starboard hand, on the west edge of the channel: three feet under water at high tide; much dreaded at night and in foggy weather. I am of opinion that this ledge should be well marked, and recommend a good spindle to be placed upon it, with a well-defined mark.

No. 10. The west point of the Yellow ledges, on the port hand, (a turning point:) a wash at high water. I recommend an iron tripod be placed on it, with a good distinguishing mark.

Course from the Yellow ledges to sea, between Whitehead and South breakers.

No. 11. South end of Garden Reef, (starboard hand:) important as a guide into a good harbor called Lobster Cove. A well-constructed spar-buoy should be placed on it. I think this is as important as any of the above recommendations.

No. 12. Governor's ledge, W. by S. of Whitehead light-house, (starboard hand;) called so from the steamer Governor running on it, August, 1852, in a fog, the bell at the light-house not then being in motion. I think it highly important that a spindle should be placed on it; it is about two feet out of water at low tide.

No. 13. South breakers, (port hand:) a wash at low water; a most dangerous ledge of rocks, being small in extent and directly in the way steering in from sea. More dreaded by navigators than all the other impediments of the channel. The distance from it to Monhegan light is twenty miles. I recommend a bell-boat to be placed on it. Vessels coming in from sea, and taking their departure for Monhegan light, run between this ledge and Whitehead light. Any mistake in their course, or bad steerage, places them in great jeopardy.

In connexion with this subject, I would again bring to your notice the necessity of an air-whistle for Whitehead light; the bell, as now erected and attended, is not sufficient—the roll of the surf destroys the sound. The whistle, on the contrary, would be more distinctive, and heard at a greater distance. This, with a bell-boat on the South breakers, would make the entrance to the Muscle Ridge channel safe at all times, fog or no fog.

I would give it as my most decided opinion, that bells, as a general thing, are not to be depended on. I have had good opportunity myself of judging of this matter, besides having the views of many experienced pilots and navigators on this most important subject. The fact is, if blowing hard, bells can seldom be heard; and when heard, the sound is so commingled with other noises, as to be confusing; which makes it, at best, a dubious aid to the navigator during the prevalence of fogs or thick weather.

The air-whistle is, undoubtedly, the best contrivance; its shrill, vigorous notes can be heard, let the storm rage as it may. Like the human voice pitched at a high key, or a boatswain's whistle, it is distinctive, and cannot fail of being recognised. On all our seacoast, entrances to harbors, and great bays, this contrivance should supersede the bell; and I know of no part of it, owing to fogs, where it is so much needed as at Whitehead light. I promised to make this statement, which must be my excuse for the digression.

I think the appropriation, properly disbursed under careful supervision, is abundantly sufficient to do all that is wanted.

I hope my views will be adopted, and that the buoys, beacons, and spindles will be placed, without delay, as they are really much required, especially for winter navigation.

The next duty which occupied my attention was the selection of a site for a light-house at Buck's harbor, Brooksville. This harbor is situated on the north side of Edge Margin reach, opposite to Little Deer island—a good, safe harbor, frequented by coasters and fishermen, having safe entrance, with no impediment or obstacle.

Edge Margin reach is the easternmost passage of the bay, used by all traders and coasting vessels bound to and from the eastward. This passage, although not so much used as the Muscle Ridge channel, is nearly as useful to commerce, and would be more so were there guides for entering it at night.

I was particularly struck with this fact, and made my examination so as to accommodate both the local and general wants of navigation, without causing detriment to Buck's harbor. The proposed position shown me is on a point of the main land called Condon Point. I find it would answer perfectly as a guide into the harbor, as a light for local purposes, but would be inadequate for general purposes. I examined several other points, and fully determined on a site which I would earnestly recommend as the most eligible and useful for all purposes required of a light. The site I recommend is on the northern extremity of a small island called Pumpkin island, off the northern extremity of Little Deer island. A light on this point would be an excellent guide into Buck's harbor; next it would show the entrance to Edge Margin reach, coming either through Long Island passage by Cape Roshway, Spruce Head passage, or Eagle passage, besides being a guide entirely through the Edge Margin reach to Long Castle Point, a distance of some twelve miles. A light on this point, if of respectable power, can be seen from twelve to fifteen miles in three directions, besides being a guide to Buck's harbor. A vessel coming from the westward, bound east, makes this light, then steers SE. for Sedwick harbor, or Tory Castle Point. If bound for the eastward, she steers directly for the light on a NW. course, which clears all the ledges and obstacles, passing between the light and the Triangles, (two ledges of rocks about one-third of a mile to the northward of Pumpkin island.) Altogether, I think this is the most eligible place, and I recommend it for the proposed light, which, if built on this site, will be one of the most useful in the whole bay. If built on Condon's Point, it would be merely a local light. The site on Condon's Point belongs to a farmer in the neighborhood, while Pumpkin island is unclaimed, as far as I can understand upon inquiry. This little island is in extent about one acre, the greater part of which is granite. A third order lens light would be all-sufficient, and better than the best lights I have seen on this coast.

After finishing my business at Bucksport, I proceeded to Vinal Haven, situated on the south of the island of the Foxes. I examined the eastern entrance to the thoroughfare. The most eligible point for a light would be on what is called Widon's island—on the highest part of it. This would guide the navigators past the middle sound, and all dangers until nearly up with the next light.

The main channel passes to the northward of this island. I think as this thoroughfare is entirely closed up by ice during the greater part of the winter, and as the passage is

not needed for the general purposes of navigation, I would not recommend the erection of a light at this point.

I consider Herring Neck, situated at the south side of the south Fox island, a more eligible and useful position for a light. It is a rocky point, or rather an island, connected with the main island by a reef under water, and lies about S. by W. from the village of Vinal Haven. Herring Neck is on the west side of Carver's harbor, a harbor of safety of easy entrance, and almost entirely free of ice during the winter; a great resort for all the coasters bound either to or from the eastward, with good and safe anchorage. Martinicus Rocks light-house bears W. by S., Saddle-back light about east, of this point.

I think this light, if a good one, will be of the greatest use to the coasters and fishermen, and I recommend its being erected, as it will answer the good purpose of a sea-light as well as a local one. I think a third order lens light would answer all required of it.

In conclusion, I would recommend the placing of two spar-buoys a little beyond Owl's Head; one of them on a small rock (with two or three feet water on it at low tide) to the westward of Owl's Head; the other on a ridge to the SW. of Janus Point, with the water on it at low tide. They lie immediately in the route from Muscle channel to the anchorage at Rockland. Vessels running in for a harbor frequently touch on them and receive more or less damage. The exact point will be shown by any of the pilots of that port.

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Very respectfully, your obedient servant,

MAXWELL WOODHULL,

Lieut. Comg. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,

Superintendent U. S. Coast Survey.

APPENDIX No. 36.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, enclosing a report of Lieut. Comg. C. H. McBlair, U. S. Navy, assistant in the Coast Survey, of an examination into the necessity and location of light-boats on Succonesset shoal and Killpond bar, coast of Massachusetts.

COAST SURVEY OFFICE, *January* 4, 1853.

SIR: I have the honor to communicate to you, for the information of the Light-house Board, instructions addressed by me to Lieut. Comg. Charles H. McBlair, U. S. Navy, assistant in the Coast Survey, and his report in relation to the necessity for and location of a light-boat near Succonesset shoal, north channel Martha's Vineyard sound, and of a light-boat on Killpond bar, or light-house in its vicinity. The report is accompanied by two charts, showing the shore-line and hydrography of the vicinity of each locality.

I concur in the recommendations of Lieut. Comg. McBlair, of a light-boat in each of the positions indicated on the chart, and in reference to a bug-light (not provided for in the appropriation) on the breakwater at Bass river.

This report is made in compliance with the law, and in consequence of the action of the Light-house Board under it.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,

Secretary of the Treasury.

NEAR BATH, MAINE, *September* 29, 1852.

SIR: Before passing from the south coast of Massachusetts please make examination and report to me, as early thereafter as practicable, the necessity or expediency of placing—

1. A light-boat near Succonesset shoal, north channel Vineyard sound.

2. For a light-boat near Killpond (or Killpad) bar, or a light-house in the vicinity of it, at Hyannis.

Appropriations have been made in the act approved August 31, 1851, making appropriations for light-houses, light-boats, buoys, &c., for these objects, and the Light-house Board has required an examination of them under the provision of the same law.

To enable you to understand the scope of the duty thus intrusted to you, I refer to the instructions and action in relation to similar matters last year, and the accompanying extract from the law:

"SECTION 6. *And be it further enacted*, That the officers so directed shall forthwith enter upon the discharge of the duty, and after fully ascertaining the facts, shall report: first, whether the proposed facility to navigation is the most suitable for the exigency which exists; and, second, where it should be placed if the interests of commerce demand it; third, if the thing proposed be not the most suitable, whether it is expedient to make any other kind of improvement; fourth, whether the proposed light has any connexion with other lights, and if so, whether it cannot be so located as to subserve both the general and the local wants of trade and navigation; and, fifth, whether there be any, and if any, what other facts of importance touching the subject."

A hydrographic reconnaissance or preliminary survey should be made for designating the places of these objects if recommended, and for furnishing the necessary information in regard to their uses and positions.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Lieut. Comg. CHARLES H. MCBLAIR, *U. S. N.*,
Assistant U. S. Coast Survey.

COAST SURVEY OFFICE, *December* 14, 1852.

SIR: In compliance with your instructions of 29th September, an examination has been made to determine the most suitable location for lights at or near Succonesset shoal and Killpond bar.

I have respectfully to recommend, for the safer navigation of the north channel of Martha's Vineyard sound, that a light-boat be placed off Succonesset shoal, at a point indicated in the accompanying sketch, marked A.

This light would occupy an intermediate position between those at Nobsque and Point Gammon, and the three seen in succession by passing vessels would enable them to shape their courses so as to command the best water and avoid all danger. It would be advisable, on establishing this light, to have the buoy now marking the shoal removed to the fourteen-foot spot lying to the southward and westward, and shown in the sketch.

I would also recommend that a light-boat be placed off the southern extremity of Killpond bar, at a point designated in the sketch herewith enclosed, and marked B.

This would be a highly useful light to the numerous coasters and packets which touch at Chatham on their way through the sound, and to transient vessels bound in the same direction, which have been forced by stress of weather to take refuge under the north shore to the eastward of Harwich. It would also serve to guide vessels to the anchorage

under the lee of the shoal; answer all the purposes of the fishing and other craft belonging to Harwich; and when used in connexion with the Point Gammon light, facilitate the approach to the Bass River harbor.

A considerable anxiety is felt by the inhabitants of the neighboring coast with regard to the location that may be determined upon for this light, and there exists a wide difference of opinion among them, growing out of peculiarities of local interests, as to the most eligible position. As exhibiting fully the views and wishes entertained by the opposite parties, I beg to invite your attention to the enclosed documents, consisting of letters addressed to me on the subject by the citizens of the several towns in the vicinity.

I will only add, that while I believe the location I have selected for the light provided for by the present appropriation will combine more general and local advantages than any other, I am of opinion that an additional light of the smallest class, placed on or near the Bass river breakwater, would be found very serviceable to the trading vessels belonging to South Yarmouth and Dennis, and to a large number belonging elsewhere, which make harbor off Bass river.

A small bug-light has already been established here, (see Sketch B,) and is maintained by private contribution, for which a more efficient one should be substituted at the expense of the government.

Respectfully, yours,

CHAS. H. McBLAIR, *Lieut. Comg. U. S. N.*,
Assistant U. S. Coast Survey.

Prof. A. D. Bache,
Superintendent U. S. Coast Survey.

APPENDIX No. 37.

Report of Lieut. Washington A. Bartlett, U. S. Navy, assistant in the Coast Survey, of an examination of Mill reef, in the Kill-Van-Kull channel, at Constable's Point, New Jersey, and on the necessity for a light-house there.

Washington, *April* 20, 1852.

Dear Sir: In compliance with your instructions directing me to examine the Mill reef, in the Kill-Van-Kull channel, at Constable's Point, New Jersey, and to report on the necessity for a light-house being constructed there to protect vessels from loss on said reef, I have the honor to report, that since the opening of the navigation in Newark bay, I have made several examinations of said reef with a view to this report, and find that the reef extends from the north shore to one-half the distance across the channel, apparent towards Staten Island, and that the reef is covered by water for three-fourths of the tide; but, although this reef is a serious hindrance to the clear navigation of the channel at night, I cannot recommend the construction of a light-house on said reef, because Robin's reef light and Bergen Point light are clearly within the usual limits of vision when vsssels ordinarily attempt the passage.

But I consider there are very many good reasons which should determine in favor of the construction of a suitable and substantial stone beacon, to be raised fifteen to twenty feet above high-water mark; and so well constructed as to withstand the heavy press of the ice when it breaks up in Newark bay.

Such a structure can be built on the extreme end of the reef, and will be at the very edge of the navigable channel.

A stone beacon will give every facility for showing the point of the reef at night as well as by day. The navigable channel of the Kill-Van-Kull skirts the south shore. In my judgment, a suitable and permanent beacon can be constructed for four thousand dollars; and the trade by steam and sail vessels through this channel is of such importance to New Jersey and the whole country, as to demand this outlay.

I do not present any plan of the ground, because when it is determined to build, the engineer officer who projects the plan and superintends the work should make a personal examination of the bottom to secure his foundation upon.

In connexion with this, I would state that it is of great importance that the so-called "corner stake," to the west of Shooter's island, at the only point where steamers can pass at half-tide, should be replaced by a superior "screw-pile," which will penetrate the harder strata below the alluvium, and thus offer a greater resistance, with less surface, than the logs placed there last year, and carried away by the ice in the past winter.

I would also remark, that although buoys can indicate both of these turning-points in the day-time, they are useless at night; and permanent structures, which shall be elevated above the dark outline of the land, should be put up in both places.

Very respectfully, your obedient servant,

WASHINGTON A. BARTLETT,
Lieut. U. S. Navy, Assistant U. S. Coast Survey.

A. D. BACHE, LL. D.,
Superintendent U. S. Coast Survey, Washington.

APPENDIX No. 38.

Report of Lieut. Comg. M. Woodhull, U. S. Navy, assistant in Coast Survey, to the Superintendent, upon the placing of the buoys in Fire Island inlet.

U. S. SURVEYING SCHOONER MADISON,
New Bedford, June 23, 1852.

SIR: I have the pleasure to enclose Mr. Preble's report concerning the placing of the buoys at Fire island, upon which duty he was detailed by me; also, a sketch of the light-house and keeper's house as it now is. Since the sketch was made, which is printed on the middle sheet of Long Island, the changes I send you have been made. I also send you the positions of the buoys.

Very respectfully, your obedient servant,

MAXWELL WOODHULL,
Lieut. Comg. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

NEW YORK, *June 2, 1852.*

MY DEAR SIR: Agreeably to your instructions of the 29th ult., I left New York last Thursday, and proceeded by land to Fire island, in order to meet the light-house schooner Sunbeam, and attend, as you directed, to the placing of four buoys at that inlet, and to determine their positions when placed. In consequence of a dense fog, the schooner did not reach the inlet until late the following Sunday, and I therefore was unable to commence the work assigned me before Monday, when I succeeded in having the four buoys placed in the positions that in my judgment seemed the best adapted for guiding vessels into the inlet, while the channel remains as it is at present.

The following general directions will, I think, prove sufficient to guide vessels into the inlet, premising that the compass courses mentioned must be varied according to the strength and stage of the tide, which at the outer buoy runs very strong.

The outer channel buoy, painted black and white in alternate perpendicular stripes, is placed at the entrance of the inlet. Any vessel bound in may stand for it, after bringing it to bear to the northward of east or west, and can pass it on either hand. It is placed in sixteen feet of water at low tide. From this outer buoy steer by compass north for the inner channel buoy, which is also painted in black and white stripes, and may be passed on either hand. It is placed in twelve feet of water at low tide. From the inner channel buoy the course is NNW. to the red buoy, which is placed to the western point of the Democrat shoal, in sixteen feet water. Around this buoy the tide sets with such rapidity as nearly to submerge it. This evil can only be remedied by putting the buoy further up on the shoal, where, as a guide, it would be nearly useless. Leaving the red buoy on the starboard hand, steer towards the black buoy, which is on the point of Farm shoal, in ten feet water; and leaving it on the port hand, stand SE. by E. for the light-house anchorage.

The entrance to Fire Island inlet has undergone a radical change since the survey of it, which is exhibited on the Coast Survey chart. The western shoal has extended more to the southward and eastward. A shoal point has made out to the southward of the light-house, and a new shoal has formed between these two, leaving a narrowed, and, as reported to me, deepened entrance to the eastward of it, and a shoaler channel on its western side. The Democrat shoal, inside and to the westward of the light-house, now marked by the red buoy, has extended to the westward, as has also the Farm shoal, called "Shifting sand" on the Coast Survey chart, and now marked by the black buoy. The channel-way between the two shoals is now nearly NW. by W. and SE. by E. to the anchorage, instead of winding first to the northward and eastward, and then south, as represented on the chart.

I am further informed, by residents in this neighborhood, that the entrance to New inlet has also materially changed, and that Gilgo inlet is completely closed across its outer bar.

* * * * * * * * * *

The house marked upon the chart to the ENE. of the light-house has been burnt down these many years, and two others have been erected between the light-house and it—one of these last quite a large hotel.

The telescopic view of Fire Island light-house, on the chart, is also incorrect, the keeper's house having received the addition of another story, &c., the temporary signal down, as also the tripod over the west base. Dominico's hotel should be added to the view, as it shows very prominently from the beach; and so also should "the life-boat house," if it is not from the point of view shut in behind the light-house. I have endeavored, in a rough sketch that accompanies this, to present a corrected view of the keeper's house and adjuncts, from near the same point of view, and also from a nearer position on the beach, at about the same points of bearing.

I also forward the angles taken by me for determining the positions of the buoys; not so good as I could wish, but the best I could obtain without considerable delay and increased expense in putting up signals. The channel shifting so much, the buoys can have no permanent positions, and I would recommend their being looked after and replanted yearly.

The buoys have all been painted, in accordance with the law of Congress regulating the same, passed September 28, 1850. In placing them I received every assistance that I required from Captain Smith, of the Sunbeam, and his pilot, and availed myself of their

suggestions, the chart being of little or no use; and having completed the work, I returned to New York.

I have the honor to be, very respectfully, your obedient servant,

GEO. HENRY PREBLE.

Lieut. Comg. MAXWELL WOODHULL, *U. S. N.*,
Assistant U. S. Coast Survey.

APPENDIX No. 39.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, enclosing the report of Lieut. M. Hunt, U. S. Navy, assistant in the Coast Survey, upon the examination of the necessity for a beacon on West Oyster Bed, Newark bay, N. J.

COAST SURVEY OFFICE, *October* 25, 1852.

SIR: I have the honor to transmit to the department, with the request that it may be forwarded to the Light-house Board, a copy of my instructions to Lieut. Montgomery Hunt, U. S. Navy, to make an examination of the necessity for the erection of a beacon in Newark bay, with a copy of his report. The beacon referred to is appropriated for in an act of August 31, 1852, and the examination was required by the board under the 6th section of the act.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, MAINE,
September 29, 1852.

SIR: Please proceed, at your earliest convenience, to make an examination and report of the necessity for the erection of the beacon appropriated for by the act of Congress of August 31, 1852, on the shoal in Newark bay, known as the West Oyster Bed; the objects to be answered by such beacon; the kind of beacon desirable—whether lighted or not; the facilities and difficulties of the foundation, of lighting, &c.; the precise site, &c. It will be desirable to bore through the crust of the shoal and to determine the character of the soil below as well as on the surface. You will judge whether a preliminary survey is necessary on a larger scale than that presented by Captain Gedney's Coast Survey work, to which I refer you (in the office of the Survey) for information. This examination is required by the Light-house Board under the 5th section of the act referred to above. That you may see the full scope of the law, I refer you to the enclosed copy of the 6th section, prescribing the nature of the report required.

I enclose a letter to the collector of New York, in case you should find it desirable to use the schooner attached to the light-house establishment for this examination.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Lieut. MONTGOMERY HUNT, *U. S. N.*,
Assistant U. S. Coast Survey.

COAST SURVEY OFFICE, *Washington, October* 10, 1852.

SIR: Agreeably to your instructions, addressed to me under date of the 29th September, I have visited the West Oyster Bed shoal, in Newark bay; and after a careful examination of the same, and a due consideration of all the facts I could obtain from those who are supposed to be acquainted with the channel and interested in the navigation of the bay, I have the honor to report as follows:

The Oyster Bed shoals, known as East and West Oyster Beds, are distant from each other about nine hundred metres, and designate the main channel up Newark bay immediately after it rounds the light-house on Bergen Point. The buoys on the shoal bear diagonally across the channel, and lie in fifteen feet for the west and six feet for the east buoy at mean low water. The west shoal, which I was directed to examine, is composed of oyster-rock, very hard for that character of bottom. Three strong men could thrust a heavy pointed instrument but about three inches into the bed, which was so tenacious of its hold that they had some difficulty in recovering the instrument. Between the shoals the bottom shelves off very abruptly from six feet to fifteen, and then suddenly to thirty feet. At about fifteen metres to the southward and westward, and due west of the west buoy, the soundings are six feet, and continue decreasing towards the west Jersey shore. Vessels bound to Newark, after rounding the Bergen Point light-house, steer for the west buoy, when it can be seen, and after coming up with it, may safely shape a course up the bay until they approach the obstructions in the vicinity of the Passaic light-house. It is therefore obvious, from the character of the channel and the shoal water on either side of it, that the passage ought to be distinctly marked. If a direct course from Bergen Point light-house would carry a vessel between the buoys, no further guides than those at present in existence would be required, could they always be found; but this is not the case, as the channel makes a complete elbow after passing the light, and the vessel is therefore obliged to obtain a sight of the west buoy in order to strike the passage.

With these facts in view, I think I may prudently recommend the erection of a dumb-beacon at the distance of eighty metres to the southwest of the west buoy, where the water is from four to six feet deep, and where the six-feet curve passes sufficiently far to the eastward to preclude the probability of the proposed beacon sliding off into deep water or in any way interfering with the channel. The description of beacon which has been most successful in this bay is the "block beacon." Those built at the "Corner Stake shoal" and "Elbow Point" appear to be sufficiently strong and large; they cost about twelve hundred dollars each. A similar one at West Oyster Bed would greatly facilitate the navigation of Newark bay, and probably fulfil all the wants of commerce in this vicinity for some years to come. It may not be improper to remark that some twenty sail of vessels, from seventy-five to one hundred and fifty tons burden, and ten steamers and propellers, pass the West Oyster Bed daily on their way to and from the city of Newark.

In reply to that part of your instructions which refers to a resurvey of that portion of the bay adjacent to the West Oyster Bed shoal, I have to say that I am not aware of the necessity of any immediate action upon the subject, but would respectfully suggest that the new structures, to wit: the "Passaic light-house," the "Bergen Point light-house," and the beacons at the "Corner Stake" and "Elbow Point shoals," be marked upon the future charts of this bay. I am under great obligations to Mr. Maxwell, the collector at New York, for the facilities which he furnished me in making the reconnaissance. A sketch of the site of the proposed beacon is herewith enclosed.

Very respectfully, your obedient servant,

MONTGOMERY HUNT, *U. S. N.*,
Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 40.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, enclosing the recommendation of Lieut. Comg. J. J. Almy, U. S. Navy, assistant in the Coast Survey, for placing spar-buoys in Metomkin inlet, seacoast of Virginia.

COAST SURVEY STATION, NEAR PETERSBURG, VA.,
August 10, 1852.

SIR: I have the honor to transmit to the department extracts from a report of Lieut. Comg. John J. Almy, U. S. Navy, assistant in the Coast Survey, recommending the placing of four spar-buoys in Metomkin inlet, on the seacoast of Virginia, and giving a sketch which shows the positions for the buoys according to the present form of the channel. I would call the attention of the department to the recommendation with which the report closes, that these buoys should be changed in position from time to time by a trustworthy pilot or other person, as the channel changes, so that they may always indicate the channel.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

U. S. COAST SURVEY STEAMER HETZEL,
Locust Mount, Accomack Co., Va., July 31, 1852.

SIR: In obedience to your directions, I herewith transmit a sketch of the soundings of Metomkin inlet, showing the locations where I propose to place the buoys which I recommended, and which would very much facilitate the ingress and egress of vessels. The buoys which I propose to place there are the usual kind of spar-buoys, to be colored and numbered in accordance with the act of Congress of September 28, 1850.

* * * * * * *

The channel leading into Metomkin inlet is narrow, but it is straight, as you will perceive. The directions of the channels, and the depth of water in them, and in all the inlets on the seacoast of Virginia, change much more than I had any idea of until this season's service and the numerous conversations which I have lately had with the residents about here, with fishermen, and the masters of coasters. I have run some lines of soundings *again* at the Chincoteague inlet this year: the depth of water I find the same as last year, but the direction of the channel and the form of the reefs have somewhat changed. After a series of heavy easterly blows, these people inform me that there is almost always a change.

Last year there was deeper water in Metomkin inlet than was ever before known, as fifteen feet had been carried in at a usual high tide. In September last, when passing with the steamer "Legaré," I sent in a boat to sound, knowing that it was pretty near low tide, and the least water found in the channel was eleven feet. This spring, when I entered the first time with the "Hetzel," eleven feet was the least which the lead gave, and I thought that the tide had just commenced running flood, but I afterwards found that it was pretty well up. The water has been gradually shoaling during the season, and the people here say that it must now have reached its least depth, as they have never known at any time less than eight feet at low water. This will account for the discrepancy in the depth which I made in my report early in the season, and the depth upon this sketch after being now thoroughly sounded out by boats. By this sketch you will perceive that in a few places in

the channel there are now but eight feet at low water, with three and a half feet usual rise, and frequently four, giving good water for large, loaded coasters through a good straight channel. It is the best inlet which I have seen about here; and this steamer has been enabled to go in and come out at all stages of the tide without touching bottom.

I would most urgently recommend that when these buoys are placed in the several inlets, as recommended by the Coast Survey, a person be appointed by the collector of the district to examine them at least once in three months, to shift them if necessary, and see that they properly mark the channels.

I am, sir, very respectfully, your obedient servant,

JOHN J. ALMY,
Lieut. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 41.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting the report of Lieut. W. B. Whiting, U. S. Navy, assistant in the Coast Survey, in reference to the location of a light-house on Jones' Point, Alexandria, Va.

COAST SURVEY OFFICE,
October 25, 1852.

SIR: I have the honor to communicate to the department, for transmission to the Light-house Board, my letter of instructions to, and copy of the report of, Lieut. W. B. Whiting, U. S. Navy, assistant in the Coast Survey, in reference to a light-house on Jones' Point, near Alexandria, for which an appropriation was made by Congress in the act of August 31, 1852, and of the necessity for which an examination was required by the Light-house Board. The report of Lieut. Whiting, in which I concur, recommends the establishment of this light.

For the consideration of the board there are suggested, in addition:

1st. The establishment of a beacon-light on the wharf at Washington;

2d. Of a similar light on the arsenal wharf at Greenleaf's Point;

3d. The placing of a buoy at the extremity of the "Point of Mud" making out at the mouth of Broad creek, south of Rozier's bluff;

4th. Of a buoy on the extremity of the shoal which makes out from the western shore of the Potomac, at the bend by Fort Washington.

Very respectfully yours,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, ME.,
September 29, 1852.

SIR: Please make an examination and report of the necessity for a light-house at Jones' Point, on the Potomac river, near Alexandria, for which an appropriation has been made in the light-house bill of the last session of Congress, and of which the Light-house Board has, under the law, called for an examination. If you are of opinion that a light-house is needed

you will please fix the site, and report in such way that the point may be easily found You will please also examine the foundation which it affords. You will report the distances at which the light requires to be seen, and the sector through which it must be visible, with such other particulars as may enable the law to be carried into execution.

I enclose a copy of the sixth section of the act of Congress above referred to, for your information and guidance.

As early a report as practicable is desired.

Yours respectfully,

A. D. BACHE, *Superintendent.*

Lieut. W. B. WHITING, *U. S. N.*,
Assistant in Coast Survey.

COAST SURVEY OFFICE,
Washington, October 7, 1852.

DEAR SIR: On Tuesday I went down to Alexandria in order to select the site for a light-house on Jones' Point, near that city. In order to give the proposed light a location most advantageous for the channel below as well as above, I yesterday took passage in the steamboat Baltimore, which runs to Aquia creek, returning in her in the afternoon. An additional reason for doing so was to avail myself of the information of her pilot (Mr. McGar,) who has been a pilot on the river for twenty years, and is said to be the best pilot on the Potomac.

In my opinion the proposed light will be a desirable facility to navigation, and Jones' Point decidedly the best location for it, and its best position the extreme end of the point, which is a long neck making out into the river and composed of large, broken stones—I should think a very solid foundation. Its general width is not over six or eight feet at high tide, but its extreme end is in the shape of a hook, and it has here a width, bare at high tide, of about fifteen feet. The water on either side is very shoal, so that the bottom at low water is left bare to a considerable distance, and at high tide has not over one foot depth of water anywhere within the area required for the foundation of a light-house. In freshets, however, it is often entirely submerged. It will be necessary, therefore, to secure the building by a sea-wall and solid foundation, to the height, I should think, of about five feet.

I expected to obtain a range of the Alexandria wharves with some object in Washington that would mark exactly the position preferable for the site of the light-house; but the great number of vessels congregated around the wharves rendered it impossible. I, however, got an equally good range of the market-house steeple in Alexandria over a very high chimney, crossing the narrow neck of Jones' Point nearly at right-angles, which will designate the spot with exactness. I enclose an accurate sketch.

The distance at which this light should be visible is six and a half miles, and its sector of visibility 165°.

I take the opportunity of this report to recommend strongly the establishment of a beacon-light on the wharf at Fort Washington. I conversed on the subject with many pilots, steamboat captains, and masters of river-craft, and they all represented to me that a light was more needed at this point than anywhere else on the Potomac river. The channel is very narrow here, running close to the eastern shore, and making a sharp bend of as much as 90°, while extensive flats make out from the western shore, making the passage in a dark or thick night a very dangerous one; so much so, that vessels bound up, if overtaken by night before reaching Fort Washington, generally drop anchor in the reach below the fort and wait for daylight before proceeding further. Captain McCausland, the general agent and superintendent of the steamboats on the mail line, told me that last Saturday night he

passed a fleet of thirty vessels, bound up, at anchor there; and last week the mail boat, in a dark, thick night, ran into the fort wharf, injuring the wharf and the boat to the amount of about fifteen hundred dollars.

The establishment of a beacon-light here would be attended with very little expense to the government: the erection of a frame on which to suspend a suitable lantern would be all that would be required, the cost of which, including the lantern, need not exceed seventy-five dollars. The authorities of the fort maintain a constant watch on the wharf, so that the expense of attendance would be in a great measure obviated.

I would also recommend the establishment of a similar light on the arsenal wharf at Greenleaf's Point, Washington, and the placing of a buoy at the extremity of the "Point of Mud" making out at the mouth of Broad creek, south of Rozier's bluff. A double advantage would attend the establishment of a wharf-light at the arsenal. The channel at that point is very narrow, and passes close to the wharf, making a considerable bend there, following the curve of the shore up to the Washington wharves. It would also serve as a guide to clear the "Point of Mud" off Broad creek. The rule now is, after passing Fort Washington, to steer for Christ Church steeple, (or Jones' Point) Alexandria, until the Capitol opens a quarter of a point to the port hand of Rozier's bluff, then to steer for the Capitol until past the bluff, after which steer again for Alexandria. It is evident that at night these ranges are not available; but a wharf-light at Arsenal Point would be distinctly visible, and equally serviceable for the same purpose; while, like a light at Fort Washington, the only expense attending its maintenance would be the expenditure of oil.

The "Point of Mud," at the mouth of Broad creek, is a great annoyance to vessels navigating the river, those not intimately acquainted with the peculiar curve of the channel here being almost sure to get aground upon it; hence the desirableness of a buoy to mark it.

A buoy, I think, should also be placed on the extremity of the shoal that makes out from the west shore at the bend by Fort Washington.

Very respectfully your obedient servant,

WILLIAM B. WHITING,
U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. Bache,
Superintendent U. S. Coast Survey.

APPENDIX No. 42.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting the report of Lieut. Comg. J. J. Almy, U. S. Navy, assistant in the Coast Survey, on the examination into the necessity for a light-house or light-boat at Puncoteague, Virginia.

Coast Survey Office,
November 24, 1852.

Sir: I have the honor to transmit to the department, for the Light-house Board, a report in relation to the necessity for a light-boat or light-house at Puncoteague creek, made according to their request, under the law. It will be seen by the report of Lieut. Comg. Almy, U. S. Navy, assistant in the Coast Survey, made under my instructions, that a light is necessary, and that a light-boat anchored off, or a light-house constructed near the end of the sand-spit making from the part between Puncoteague creek and Pocomoke sound, will answer the purposes of navigation. Lieut. Almy recommends a light-boat; but as the circumstances which should decide the case in reference to general policy and construction

are better known to the Light-house Board than to this office, I would prefer to leave the decision of the question with the board.

The chart will be sent as soon as prepared.

Very respectfully, yours,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, ME.,
September 29, 1852.

SIR: Please, before the close of the surveying season, to make an examination and report of the necessity of a light-boat at Puncoteague creek (Pocomoke sound, Chesapeake,) "or a light-house to be built on a point of land adjoining said creek," and of the expediency of giving preference to one or the other. The act of August 31, 1852, appropriates for one or the other, as may be judged expedient, and the Light-house Board has required a preliminary survey to determine whether either, and if either, which, shall be provided. You will accompany your report by an extract from your chart, or the topographical map of the Coast Survey, showing the place you recommend for the vessel or light-house, the uses of each, and all other particulars bearing upon the subject.

I enclose with this a copy of, and refer you, for information in regard to this duty, to the sixth section of the act of August 31, 1852.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Lieut. Comg. J. J. ALMY, *U. S. N.*,
Assistant in Coast Survey.

U. S. COAST SURVEY OFFICE,
Washington, November 11, 1852.

SIR: In compliance with your instructions of September 29th, "to make an examination and report of the necessity of a light-boat at Puncoteague creek, (near the entrance of Pocomoke sound, east side of Chesapeake bay) or a light-house to be built on a point of land adjoining said creek, and of the expediency of giving preference to one or the other," I hereby report:

That I proceeded with the steamer "Hetzel," under my command, and made the required examination, spending sufficient time there—four days—and giving the matter due attention.

I hereby report, that a light-boat would be decidedly preferable—it would be of much greater advantage to facilitate navigation than a light-house. The latter, I consider, would be of little or no use, as the danger to be avoided is a *spit* which runs out from the land between the entrance into Puncoteague creek and the entrance into Pocomoke sound. A light-boat placed at the extremity of the shoal water upon this spit would be of service at night in guiding vessels safely both into Puncoteague creek and Pocomoke sound.

As soon as the chart of this locality is completed, upon which I am now employed, I will furnish a sketch showing the position recommended for the light-boat to be placed.

As Congress has already made the appropriation either for a light-boat or light-house, whichever may be decided upon, I make this report in advance, in order that the Light-

house Board may take immediate steps to have the light-boat built if it should conclude to adopt the recommendation which is here made, and the chart can soon follow.

Very respectfully, your obedient servant,

JOHN J. ALMY,
Lieut. U. S. Navy, Assistant in Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 43.

Letter of Lieut. Comg. R. Wainwright, U. S. Navy, assistant in the Coast Survey, to the Superintendent, designating the position of beacons, &c., in James River, Virginia.

U. S. SURVEYING SCHOONER JOHN Y. MASON,
James River, December 5, 1852.

DEAR SIR: Agreeably to the request of the Light-house Board, I have the honor to make the following report of sites for beacons on James river, Virginia:

White Shoals.—The foundation is hard shell-rock, or oyster-bed; arc of the horizon necessary to illuminate is 180°; the distance to see it, between seven and eight miles. The distance from Newport News is six miles, and from Day's Point four miles. The lump examined is about thirty feet across, bare at half-tide, and the southernmost point of all. These shoals are a series of lumps extending up towards Point of Shoals about eleven miles. Some of them are a mile apart.

Day's Point.—Is a bluff twenty-four feet high, of solid ground, the property of the Hon. John Y. Mason. The arc of the horizon necessary to illuminate is 160°; distance to see it, seven miles. Its distance from Point of Shoals is seven miles. The point at which the arc was taken is twenty-nine feet from the bank, at which point I placed a stake painted white.

Point of Shoals.—The foundation is the same as at White Shoals, oyster-rock; arc of horizon necessary to illuminate is 300°, and distance to see it, seven miles. This shoal is long and narrow, and bare at half-tide. The beacon should be placed as near as possible on the southernmost point; it is nine miles from Lyon's Creek shoals.

Lyon's Creek Shoals.—The best apparent position for a beacon was in six feet water at low tide, in soft mud and sand bottom, with the lower buoy bearing east, about 180 yards distant; arc of the horizon to illuminate, 250°. It is from four to five miles to the extreme point of Hog island.

Jordan's Point.—Is solid ground, one foot and a half above high-water level, and the point from which the arc was taken is forty feet from high-water mark on both sides; the arc to illuminate is 280°, and distance necessary to see it, nine miles. Its distance from Harrison's bar is three miles, and from City Point five miles. It is the property of Dr. Thomas Bland, at Prince George's Court-house. A stake painted white was placed here.

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Respectfully yours,

R. WAINWRIGHT,
Lieut. Comg. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 44.

Report of Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, to the Superintendent, on the trial of the Hatteras bell-beacon, at Philadelphia.

NEW YORK, *September* 16, 1852.

DEAR SIR: The bell-beacon was got into the water on Saturday evening, drawing two feet one inch. By my direction, a sufficient quantity of ballast was put in to bring her down to three and a half feet draught. This work, and the adjustment of the bell and its framework, occupied the time until Tuesday afternoon, the 15th, when I subjected the vessel to a severe test in rolling, by means of ropes attached to the mast-head. Afterward I had a tackle got on the mast-head, to heave her down. When brought down so low as to cover the pontoon, the "heave" became so heavy as to risk straining, and satisfied me as to her stability. Previously to launching, I had three feet of water pumped into the vessel, and found her tight, except some slight leaks at a few of the rivet-holes, which we stopped.

The weight of the beacon, without the bell and frame-work, (weighing about 3,000 lbs.,) is fifteen tons; ballast, sixteen tons; moorings, 32,350 lbs.; chains tested to sustain thirty tons. I have directed Mr. Merrick as to securing the ballast, and agreed that all shall be delivered to me at Norfolk, time to be specified hereafter.

The buoy is made according to contract, and I have required of him a sufficient quantity of iron borings to ballast it, if necessary, as the largest end goes in the water.

I expect to get to sea on Saturday, knowing nothing to prevent.

Very respectfully, your obedient servant,

T. AUGS. CRAVEN, *Lt*
Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 44 *bis*.

Report of Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, to the Superintendent, on the placing of the bell-beacon on the outer Hatteras shoals, and of a buoy on Diamond shoals, N. C.

U. S. STEAMER CORWIN,
At sea, November 26, 1852.

SIR: I have to inform you that on the 24th of November I moored the bell-beacon on the outer shoals of Cape Hatteras and placed the buoy on Diamond shoals.

The position of the bell-beacon is inside the easternmost shoal, in four fathoms water; the light-house bearing, by compass, NNW. $\frac{3}{4}$ W., distant nine miles.

Vessels may not approach nearer than one mile and a half to the eastward, one mile to the southward, three miles to the westward.

The beacon is distinctly visible to the eye at a distance of five miles; height of eye twelve feet above the sea; and the bell can be heard about one mile.

The buoy on Diamond shoal is near the northwest spit of northern shoal, (at northeast entrance to channel,) in three fathoms and a half of water; light-house bearing NNW. $\frac{1}{2}$ W., distant three miles and a half.

Vessels may pass within one hundred yards to the northwest of buoy; course through from buoy SW. ½ W. The channel at this point is three-fourths of a mile; and for the benefit of mariners, it is well to state that the shoals lie from SSW. to SE. from buoy.

Very respectfully, your obedient servant,

T. AUGS. CRAVEN, *Lieut. U. S. N.*,
Assistant in Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 45.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting the report of Lieut. Comg. J. N. Maffitt, U. S. Navy, assistant in the Coast Survey, on the examination of Winyaw bay, (Georgetown harbor, S. C.,) with reference to the location of beacon-lights.

COAST SURVEY OFFICE, *November* 20, 1852.

SIR: I have the honor to transmit, for the information of the Light-house Board, a copy of my instructions to Lieut. Comg. Maffitt, U. S. Navy, assistant in the Coast Survey, and of a report and sketch of the entrance to Winyaw bay, (Georgetown harbor,) South Carolina, by Passed Midshipman J. P. Jones, U. S. Navy. The examination into the necessity for the beacon-light appropriated for was required by the board.

1. It appears by the report and sketch that the two beacons on South island, appropriated for, will serve to enter the "old ship channel," and to guide a vessel to an anchorage under the "Great Dry breaker," but not into the bay.

2. That one beacon on North island, marked A on the chart, might be so arranged as, with the existing light-house, to give a range at night from the northeast buoy, marked on the chart in the old ship channel, towards but not to an anchorage under North island. There being two courses from the former range to this one, which itself does not lead to the anchorage, I cannot recommend the placing of this beacon.

3. That a beacon near the spot marked B on the chart, may be placed so as to serve the light-house as a range to enter through the Southeast Pass, but that this pass is possibly not permanent either in depth or position.

4. Mr. Jones recommends two wooden lighted beacons on North island, instead of one, as appropriated for; one of them to be movable, so as to meet the case of changes in the Southeast Pass.

5. The report states that the beacons recommended could be put up of wood for about four thousand dollars, and that the land is not public property.

As a complete survey of the harbor will probably soon be made, and the question of the permanence of the Southeast Pass be determined with more probability than it can be at present, I am of opinion that the decisions in regard to this matter might be postponed to advantage.

Very respectfully, yours,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, MAINE,
September 29, 1852.

SIR: As early in the season as your Coast Survey work will permit, you are requested to examine and report in relation to the necessity for "two beacons or range-lights on South Island Point, and one beacon or range-light on North island, to range with the main light at Georgetown harbor," South Carolina. An appropriation for these beacons or range-lights has been made by Congress, and the examination is called for, under the law, by the Light-house Board. You will embrace in your report all the information necessary to determine this question, and to put up the lights if you approve them. You will also ascertain if the sum appropriated—$5,000—is sufficient for the purpose, &c. You will designate in a preliminary sketch the sites, and examine the character of the foundations, if permanent structures are necessary. I refer you for your information and guidance to a copy of the sixth section of the act of Congress referred to above.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Lieut. Comg. J. N. MAFFITT, *U. S. N.*,
Assistant U. S. Coast Survey.

U. S. SCHOONER CRAWFORD,
Off New Inlet, November 16, 1852.

DEAR SIR: I herewith enclose the report of Passed Midshipman J. P. Jones. He repaired to Georgetown, South Carolina, by my order, to examine into the necessity of channel-beacons, their probable cost, &c., as per your instructions to me in a recent order.

Mr. Jones' report is in full, and I subscribe to his suggestions.

I am, respectfully, your obedient servant,

J. N. MAFFITT,
Lieut. Comg. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

U. S. SCHOONER CRAWFORD,
Off Smithville, November 16, 1852.

SIR: In obedience to your order of the 14th October, I have made investigation in reference to the lights required for the entrance of Winyaw bay, and report as follows:

It will be seen, from the accompanying sketch, that there are two important channels to the entrance of this bay, neither of which can be used at night without being lighted.

The first, marked "old ship channel," has been in use for many years, with no material change except the *working* to the northward and westward of the point (m), and to the southward of the point (n) of the Great Dry breaker. This channel has the advantages of being permanent, well known, and of affording to the westward of Great Dry breaker the only anchorage outside the bay. It is highly important that the entrance to this channel should be lighted, and it will be best done by light-beacons at the points (M) and (n) on South island.

Without a light-boat the rest of this channel cannot be lighted, for it would so multiply the lights as to produce confusion. But vessels, after getting inside the breaker heads, by the beacons at (M) and (N), can find their way in ordinary weather, by the buoys, as far as *NE. buoy;* or they may anchor under the Great Dry breaker.

The run from NE. buoy to North island is common to both channels, and a light is required at (A) to keep vessels clear of "Raft-tree shoal" to the westward, and the "East shoal" to the east. The channel here is so wide as to render the fact of the BACK RANGE light being lower than the nearer one a matter of no importance.

The other, or eastern channel, called "Southeast Pass," has the advantages (apparent from the sketch) of a nearly straight course, more water between the breaker heads, and of affording means of getting in and out the harbor without beating in shallow water. Unless the wind be between SW. and SE., it is impossible to enter the old channel way without beating. This Southeast Pass has only been in use for three or four years, and is only known to the pilots, with whom it has nearly superseded the old channel. The objections to this channel are that it may disappear in the first gale, and that in some winds it is too rough for an entrance to be attempted with safety. It may not last; but I am decidedly of opinion that it will improve, and that it is destined to materially facilitate the commerce of Winyaw bay. I cannot, therefore, too urgently press upon you the necessity of lighting this pass, which should be done by placing a light-beacon at (B) to range with the light proposed at (A). A vessel entering this pass would run to the westward till the two lights at (A and B) were in range, and then run for them. If she did not see the buoys at (b), or the breakers as she passed them, the lead would plainly indicate when she had gotten inside the pass, and then she has ample room to steer to the northward and westward till she gets on the range for running up for North island.

Character of the lights required.—The lights at the points (M) and (N), to be seen four miles, should be small beacon-lights, such as are on Sullivan's island, Charleston harbor, with large boards or gratings on top to render them plainly visible in the day; that at (M) to be twenty-five feet high, and at (N) thirty-five. The position (M) is the pilot's range-beacon, which ranges for entering the old channel, with a conspicuous tree back of it. The point (N) is six hundred and fifty yards back of (M) on this range. The foundations are sand, but good and firm.

The light at (A) should be a wooden bug-light sixty feet high, to be seen eight miles. This position is indicated by a tree, upon which I have placed a pole. This position is on firm but sandy foundation. The light at (B) should be a beacon-light, to be seen seven miles, with a large board on top to render it plainly visible during the day. It should be forty feet high, and should stand on a railway, that it may be moved in the event of the pass changing, and adjusted to it. The railway should be built on piles five feet high, to prevent a sand bank forming about it, as the position is a system of shifting sand banks. Just at the spot upon which (B) is located is a valley, which has not changed for many years; but building any structure there, except of the character I designate, would at once create a bank. This spot is indicated by a stake driven into the sand; and should there arise any difficulty in regard to any of these positions, Mr. Marsh, the light-house keeper, and all the pilots, are familiar with their locations.

Probable expense.—In round numbers, for lights and beacons, not less than $4,000. The cost of the land I could not arrive at; but neither of the lights proposed on North island come on the ground at present owned by the government. None of the land between or about the proposed lights is in cultivation.

BUOYS.—*For Old Channel*—The NW. buoy in its present position is of little or no use. When placed there, the channel enabled a straight course to be run from it to NE. buoy; but since then the point (M) of Great Dry breaker has made between them, (as the sketch will show.) This buoy should be taken up and placed at (c), clear of the point of Great Dry breaker. The outer buoy is too small for an outer buoy; it should be placed at (d), indi-

cating where a vessel had gotten inside. A new first-class buoy should be put in the place of the outer buoy.

Southeast Pass.—First-class buoy for outer buoy at (a); second-class buoy at (b) to point out the pass. Both these are required.

Sailing directions, supposing the buoys and lights placed as herein proposed.—In day-time—for old channel: In five fathoms water, bring the beacons on South island to bear NW., and steer for them; this will bring outer buoy; continue this course and range of beacons till you come upon (d), second buoy; at this buoy change course to NNE. until up with third buoy, (c); then steer ENE. for the NE. buoy. Here light-house and buoy first (a) will be in range; run on this range for a mile, and change the course to NNW., and anchor at will under North island, avoiding South island shore. For Southeast Pass, day-time: in five fathoms water, bring light-house bearing about NNW.; bring the buoys (A) and (B) in range, and steer for them carefully, passing close to outer buoy, (a); when up with inner buoy, (b) steer NW. till light-house and back bug (A) are in range; then steer NNW. $\frac{1}{4}$ W. to anchorage; or, keeping back bug a little open to westward of light-house, steer up, giving North island a berth as you come up to it. In standing up from NE. buoy, be careful not to bring back bug (A) to the east of light-house. Keeping it a little to westward will run the channel-way up to North island.

At night—Old channel: Make the beacons on South island; get them in range and steer for them; pass outer buoy and run same course, NW., to second buoy; change course to ENE., when directions same as day-time. When at NE. buoy, steer to northward, keeping back bug to westward of light-house.

Southeast Pass.—With light-house bearing about NNW., bring the buoys on North island in range, and steer for them carefully; you will pass outer buoy, (a) and "*pass buoy*" at (b); steer this course to ten feet water, (low,) and then steer to NW. till you get back bug and light in range, and stand up the channel, keeping bug to WESTWARD of light, and taking care not to let it get to the eastward.

The necessary but unexpected absence of Lieut. Comg. Craven threw me entirely on my own resources. Hence the expenditure above my anticipation, and my long detention from the vessel.

I am, sir, very respectfully, your obedient servant,

J. P. JONES,
Passed Midshipman U. S. Navy.

Lieut. Comg. J. N. MAFFITT, *U. S. N.*,
U. S. Schooner Crawford, Assistant U. S. Coast Survey.

APPENDIX No. 46.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting the report of Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, on the examination of Cape Roman shoal with reference to the location of a bell-boat.

COAST SURVEY OFFICE, *November* 30, 1852.

SIR: I have the honor to transmit, for the information of the Light-house Board, a copy of my instructions to Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, and of his report and sketch of the examination into the necessity for a bell-boat off Cape Roman shoal, appropriated for by act of Congress at the last session. The examination was made according to the request of the Light-house Board, under the law.

It will be seen, from the report of Lieut. Comg. Craven, that he recommends a screw-pile beacon, with a bell, to be tolled by a small iron wind-mill, to be erected at the spot indicated by B ⊙, in the place of a bell-boat, as appropriated for, for the reasons that a floating boat would have to be moored at such a distance outside the shoal as to be of no service to vessels which could use the channel inside, and that it is too smooth there during westerly winds for the bell to receive the required motion from the waves.

Lieut. Comg. Craven also recommends a large buoy to be placed on the inner edge of the channel, to mark the shoal which extends off from Cape island.

Very respectfully,

A. D. BACHE, *Superintendent.*

Hon. W. L. HODGE,
Acting Secretary of the Treasury.

COAST SURVEY STATION, NEAR BATH, MAINE,
September 29, 1852.

SIR: Please examine and report, at your earliest convenience, in reference to the necessity or expediency of placing a "bell-boat," for which an appropriation was made by act of Congress of August 31, 1852, off Cape Roman shoal, an examination having, under the law, been called for by the Light-house Board. If this boat is desirable, please state the use it is to answer, the position in which it should be placed, the kind of boat necessary, and all other particulars which may occur to you in your examination as appropriate to the subject. The sixth section of the law, of which I enclose a copy, will guide you in these details.

The position of the boat should be marked on the sketch of the reconnaissance of these shoals, which it has formed part of your instructions for the season to make. The sum appropriated for this boat is $3,500.

"SECTION 6. *And be it further enacted,* That the officers so directed shall forthwith enter upon the discharge of the duty, and after fully ascertaining the facts, shall report: first, whether the proposed facility to navigation is the most suitable for the exigency which exists; and, second, where it should be placed if the interests of commerce demand it; third, if the thing proposed be not the most suitable, whether it is expedient to make any other kind of improvement; fourth, whether the proposed light has any connexion with other lights; and if so, whether it cannot be so located as to subserve both the general and the local wants of trade and navigation; and, fifth, whether there be any, and, if any, what other facts of importance touching the subject."

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Lieut. Comg. T. A. M. CRAVEN, *U. S. N.*,
Assistant in Coast Survey.

U. S. STEAMER CORWIN,
Norfolk, November 18, 1852.

SIR: In accordance with your instructions of the 29th September, I have the following report to make:

The position and character of the Roman shoals render them exceedingly dangerous, lying, as they do, directly in the track of the southern coasting trade, and I consider it very important that the situation should be clearly indicated by a suitable beacon.

There would be some objections attending a floating beacon, as it would have to be moored outside the shoals, at such a distance as would render it of no service to the many vessels which could use the channel inside, (see my report of survey,) if properly marked; and, again, it is so smooth there during westerly winds, that the bell could receive no motion from the waves.

I would suggest a screw-pile beacon to be erected on the spot indicated by B ⊙ on my sketch; five screw-piles thirty-five (35) feet long—one central and perpendicular, the others brought to it, (somewhat as our tripods,) and all well secured at the top, with a bell to be tolled by a small wind-mill (of iron.) I have a design for one if you desire it; but the bell is of secondary importance, as strangers, at night, have no business so near the shore. I also recommend a large buoy to be placed on the inner edge of the channel, to mark the shoal which extends off from Cape island, as this channel, when well marked out, will be used by all coasting vessels.

The light-house at Cape Roman should have been placed on Cape island, at the point I have marked ⊙: it would then have been one and a half mile nearer the shoal, and free from the effect of the vapors which are constantly rising from the marshes on the edge of which it is now located.

Very respectfully, your obedient servant,

T. A. M. CRAVEN,
Lieut. Comg. U. S. Navy, Assistant in Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

APPENDIX No. 47.

Letter from Judge A. Steele, of Cedar Keys, Florida, to Assistant F. H. Gerdes, U. S. Coast Survey, on the utility of a beacon on the sand bar, or reef, running out from Sea-horse key, Florida.

ATSEENA OTEE, (CEDAR KEYS,)
May 13, 1852.

DEAR SIR: Some time before leaving here, you spoke of the utility of placing a beacon on the point of the sand bar or reef running out from Sea-horse key. Though I had previously been impressed with the necessity of this, which was more strongly confirmed by your explanation of its benefits, I have still more thoroughly satisfied myself by inquiries among masters of vessels familiar with the coast. There is but one opinion about it: as a place of refuge in bad weather, the outer harbor formed by this reef is most important to the Gulf navigation; and to render it secure of easy entrance, such a guide is necessary.

During the period of the Indian war, a couple of buoys were placed at this point. They were found extremely useful, even in good weather, in guiding vessels in and out, but the unprecedented storm of 1842 carried them away. If a beacon could not be obtained, the replacement of those buoys would be of great benefit to the harbor.

From your intimate knowledge of these waters, and of the general interest here connected with their navigation, your representation of the matter in the proper quarter would have great weight; and by accomplishing the object, you will render an essential benefit to the trade of the Gulf, and to this harbor in particular.

Very respectfully, your obedient servant,

AUGUSTUS STEELE.

F. H. GERDES, Esq.,
U. S. Coast Survey.

APPENDIX No. 48.

Letter from the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting information received from Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant in the Coast Survey, in reference to Half-moon shoal, Galveston bay, Texas.

COAST SURVEY OFFICE, *May* 14, 1852.

SIR: I have the honor to transmit, for the use of the department, the following information received from Lieut. Comg. T. A. M. Craven, U. S. Navy, assistant in U. S. Coast Survey, in regard to Half-moon shoal, Galveston bay. This is the site of one of the light-houses for which appropriation was made by act of Congress March 3, 1851, and in relation to which I reported to the department June 17, 1851, that while the reasons given by Lieut. Craven for placing a light-boat near Half-moon shoal, instead of a light-house, show that caution is necessary, they are not in my mind conclusive against the construction of the light-houses, as the shoal appears to be composed of sand and shells, and is in the interior of the bay, and I recommended the construction of a light-house on screw-piles in that locality.

Lieut. Comg. Craven, under date of May 1st, states:

"In my communication of March 22 I made allusion to this shoal, but have delayed my report until opportunity afforded for making a thorough examination. A small portion of the ridge is bare at low tide this year, and I find it to consist entirely of shells, broken very fine. This was last year taken by me for quicksand, which is very fine and hard below the water. There were two feet water on the shoal when I examined it last year.

"I have sounded about the shoal with an iron-pointed rod and find it hard and firm inside of six feet. On the northerly side the water deepens regularly, but very rapidly. On the southerly side it is steep at first, but deepens regularly outside of five feet. A section of the shoal from north to south would give a profile nearly as per diagram, terminating in a sharp ridge. * * * Outside of seven feet, the bottom is soft mud."

Very respectfully, yours, &c.,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

APPENDIX No. 49.

Report, in part, of the Superintendent of the Coast Survey to the Secretary of the Treasury, of the advantages of Bonita Point over Fort Point as the location of a light-house at the entrance of San Francisco bay, California.

COAST SURVEY OFFICE, *April* 24, 1852.

SIR: Lieut. Comg. Alden, U. S. Navy, assistant in the Coast Survey, and Assistant R. D. Cutts, having reported that in their opinion, and that of many nautical men who commanded vessels, especially steamers, entering and leaving the port of San Francisco, a light-house on Bonita Point, at the north side of the entrance to the bay, would be more useful than one on Fort Point, if only one light were provided, I directed him to furnish further information on the subject, and now transmit what may be considered as a report in part in relation to it.

Copies of the letters of Lieut. Comg. Alden, and of the captains of the steamers Tennessee, California, and Golden Gate, are herewith transmitted, for the information of the department.

I have requested Lieut. Comg. Alden to examine this subject in reference to the wants of sailing-vessels, and to obtain the advice of some experienced navigators commanding such vessels, in relation to it. It may very well happen, as the steamers follow the land, both in coming from the northward and southward, while sailing-vessels coming from the southward are obliged to stretch off to sea to the westward, and thus to make the Farallones islands before entering the port, that the wants of the two kinds of navigation are different.

When further information is received, I will transmit it to the department.

Very respectfully, your obedient servant,

A. D. BACHE, *Superintendent.*

Hon. THOS. CORWIN,
Secretary of the Treasury.

U. S. SURVEYING STEAMER ACTIVE,
San Francisco, March 19, 1852.

SIR: Agreeably to your request, I send herewith a copy of a letter addressed by me to the commander of the steamships belonging to the Pacific Mail Steamship Company, in relation to the location of the light at the entrance of this harbor, together with the replies of Captains Patterson, Totten, and Whiting. So soon as the others are received, they shall be forwarded.

I have addressed a communication of the same nature to other gentlemen whose judgment can be relied on in such matters: their answers, when received, shall be sent to you.

I have found no one, as yet, who does not agree with me in the opinion I have already advanced on the subject; they all go to show that Bonita Point is of the first importance, and that it should have a light on it of the first magnitude, before all others.

* * * * * * * * * *

With great respect, your obedient servant,

JAMES ALDEN,
Lieut. Comg. U. S. Navy, Assistant Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

PACIFIC MAIL STEAMSHIP TENNESSEE,
San Francisco, March 16, 1852.

SIR: I have just received your favor of the 1st instant, in relation to the matter of position for the light-house for this harbor.

I am surprised that Fort Point ever should have been suggested as the proper spot; the object of a light-house, I take it, being to show vessels coming from sea where the port is.

Now, that point from which the light can best be seen seaward, or which will enable vessels coming from any direction to find the port, is the best position. Now, this is not the case so far as Fort Point is concerned, for a light there could not be seen at all, until after the port is found and the entrance open in a certain direction.

At Bonita Point the light could be seen from any direction at sea; and once discovered, it would be easy, under almost any circumstances, to enter the port.

Coming from the southward, trusting to a light on Fort Point, should it happen to be obscured by fog or otherwise, there would be ten chances to one that the vessel would be run upon Point Bonita before that was discovered.

With a light on Bonita Point, I should have been saved many anxious nights, and have avoided great risk to my ship.

For this port there should, in my opinion, be a light on one of the Farallones, one on Bonita Point, and a beacon or bug-light on Fort Point; good fog-bells at each of the light-houses, and a bell-buoy on the bar.

At Monterey, a light on Point Pinos, with bell.

At San Diego, a light on the bluff of Point Loma, and bug-light on the point of break-water.

If I can at any time be of service to the Survey in the way of collecting information within the range of our route to and from Panama, I shall be much gratified to be called upon.

With great respect, I am your obedient servant,

GEO. M. TOTTEN,
Lieut. U. S. Navy, Comg. Pacific Mail Steamship Tennessee.

STEAMSHIP CALIFORNIA,
San Francisco, March 9, 1852.

DEAR SIR: Your communication of the 1st instant, asking my opinion as to the best locality for a light-house at the entrance of the harbor of San Francisco, has been duly received.

As the chief object of this light-house is to point out the entrance of the harbor, it would seem to me that the position for a light should be at some point at the entrance, where it could be seen from all points of the compass in running for the harbor.

At Fort Point, the light could not be seen by vessels coming from the southward until nearly up with the mouth of the harbor.

Point Bonita appears to me the place possessing the most advantages, and I must decidedly recommend its location at that point.

I am, sir, your obedient servant,

R. L. WHITING,
Commanding Steamer California.

PACIFIC MAIL STEAMSHIP GOLDEN GATE,
Benicia, March 12, 1852.

DEAR SIR: I have just received yours of the 1st instant, requesting my opinion respecting the location of the light-house at the entrance to San Francisco bay.

As the use of a light-house is to show to vessels outside, the position of the port, and as it should be so located as to be the best guide to the entrance, I cannot see why Fort Point should have been selected at all. It possesses no advantages over Bonita Point, and its disadvantages are—

1. The light could be seen only when nearly directly abreast of the port.

2. It could not be seen at all when to the northward or southward, and close in shore, as the steamers run, as the land would intervene.

3. It is always advisable to keep the north shore "aboard" when coming in at night, on account of the "mile rocks" lying outside of Fort Point, and to the north of Point Lobos.

4. The "mile rocks" cause the necessity of running well to the northward and getting Fort Point on a bearing before you can run in.

5. It is frequently foggy at Fort Point when Bonita Point is clear; and when a fog clears, it generally does so outside first. The only advantages of Fort Point over Bonita Point are those of economy and construction, and convenience and comfort to the keeper.

The advantages of Bonita Point are—

1. It is an outside location, and can be seen both up and down the coast as far as the light can shine.

2. It can always be run for *direct* in any course that will clear the coast.

3. The proper course in at night is to run for it, and keep the north shore aboard.

4. When it is clear enough to pass Bonita Point, Fort Point can always be seen in sufficient time to clear it; and if not, a single course takes you in to an anchorage.

On account of the fogs so prevalent on this coast, I would suggest that the light-house be placed as near the water as possible. The fog frequently *lifts* for one or two hundred feet in height, close in along the highlands, such as are over Bonita Point. In the steamers we constantly depend upon this "lift" when running along the coast.

Most respectfully, yours,

C. P. PATTERSON,
Lieut. U. S. Navy, commanding Golden Gate.

Lieut. Comg. JAMES ALDEN,
Lieut. U. S. N., Assistant U. S. Coast Survey, San Francisco.

APPENDIX No. 50.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting further information showing the advantages of Bonita Point over Fort Point as the location of a light-house at the entrance to San Francisco bay, California.

COAST SURVEY OFFICE, *May* 21, 1852.

SIR: Referring to my communications of April 24th to the department, in relation to the light-house at Fort Point, entrance to San Francisco bay, I have the honor to enclose further information sent by Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey, on the same subject.

On a review of the reports in relation to the matter, I would respectfully recommend that the light-house at Fort Point be constructed for a harbor-light merely, and that an appropriation be asked for a sea-coast light of the first class at Bonita Point.

Very respectfully, yours,

A. D. BACHE, *Superintendent.*

Hon. THOMAS CORWIN,
Secretary of the Treasury.

U. S. SURVEYING STEAMER ACTIVE,
Monterey, April 11, 1852.

DEAR SIR: I enclose herewith copies of letters of Captains Ottinger, Dale, and Harford. They relate to the advantages possessed by Bonita Point over Fort Point for a light-house. Indeed, there seems to be but one opinion here in regard to the matter.

* * * * * * * * * *

I am, very respectfully, your obedient servant,

JAMES ALDEN,
Lieut. Comg. U. S. Navy, Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

PACIFIC MAIL STEAMSHIP CONSTITUTION,
At Sea, March 19, 1853.

DEAR SIR: Your favor of March 1st came duly to hand, and would have received an earlier reply, had not the urgency of my business prevented.

I enter warmly into your views of the evident superiority of Bonita Point as the site of the contemplated light-house, preferring, as I do, this to that of Fort Point.

Numerous reasons lead me to this choice; among which may be given, the more open and seaward location of Bonita Point, rendering it visible at a great distance, and its position with reference to the bar greatly facilitating an entrance into San Francisco bay.

On the other hand, I see nothing which makes Fort Point, as a site for a light-house, comparable with Bonita Point.

I am, sir, your obedient servant,

K. F. HARFORD,
Master Steamship Constitution.

Lieut. Comg. JAMES ALDEN,
U. S. Navy, Assistant U. S. Coast Survey.

PACIFIC M. S. CO.'S STEAMSHIP COLUMBIA,
San Francisco, March 28, 1852.

DEAR SIR: About two weeks since I received a communication from you, asking my opinion as to the most suitable site for a light-house at the entrance of San Francisco harbor. I am sorry that I did not receive it until the day of my departure for Oregon, and thus could not reply before.

From my own observation I should give the preference to Point Bonita, as being the farthest westward and more open to the sea, so that vessels coming up or down the coast can see it as far as a light can be seen.

A light on Fort Point would only be open from W. to SW. by S., (but five points.) A light on Point Bonita would be open from NW. to SSE., (eighteen points.) Vessels coming up the coast in a fog often make Point Bonita, and are not certain what point it is. If there were a light-house on it, it would afford a good mark to run directly into the harbor by. I do not think there is any possibility of a light-house being useful for such a purpose on Fort Point, as vessels never get in the bay in a fog, except by accident; and if they were to make Fort Point, they would know it without a light-house.

As far as the route of this steamer is concerned, (San Francisco to Oregon,) I would much prefer, and consider it a great advantage, to have a light-house on Point Bonita.

Very respectfully, your obedient servant,

WM. L. DALE, *Commander.*

Lieut. JAMES ALDEN, *U. S. N.*,
Assistant in Coast Survey.

U. S. REVENUE CUTTER FROLIC,
San Francisco, April 2, 1852.

DEAR SIR: In reply to your letter respecting the change of opinion in the matter of selecting a site for the light-house at the entrance to this bay, I will state that I was one of many who recommended Fort Point as the proper place for a light; but, from careful examination, I am now fully satisfied that Bonita Point not only possesses all the advantages of Fort Point, but others of importance.

A light on Fort Point cannot be seen by navigators coming from the southward until it bears about NE. by N., and therefore would not be of any value to vessels coming from that quarter, until the entrance to the harbor is entirely open; and should a beacon-light be placed on Yerba Buena island, the range to clear Blossom Rock is as good.

I am, very respectfully, your obedient servant,

DOUGLASS OTTINGER,
Captain U. S. Revenue Cutter Frolic.

Lieut. Comg. JAMES ALDEN, *U. S. N.*,
Assistant in Coast Survey.

APPENDIX No. 51.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting further information in regard to the proposed light-house at Bonita Point.

COAST SURVEY STATION, NEAR PETERSBURG,
June 17, 1852.

SIR: I have the honor to enclose herewith a copy of another communication from Lieut. Comg. James Alden, U. S. Navy, assistant in the Coast Survey, in relation to the proposed light-house at Fort Point, entrance to San Francisco bay.

It will be seen that they are in confirmation of my recommendation of May 21, that a seacoast light of the first class should be placed at Bonita Point.

Very respectfully, yours, &c.,

A. D. BACHE, *Superintendent.*

Hon. W. L. HODGE,
Acting Secretary of the Treasury.

U. S. SURVEYING STEAMER ACTIVE,
San Francisco, May 15, 1852.

DEAR SIR: I enclose herewith a copy of a letter from Captain Watkins, of the Pacific Mail Steamship Company's service, in relation to the advantages possessed by Bonita Point over Fort Point for the location of a light-house at the entrance of this harbor.

This is the seventh communication of the same nature that I have received from intelligent individuals conversant with the matter, and copies have been forwarded to you. Should it be thought necessary, I could obtain as many more. Indeed, there is but one opinion out here upon the subject, nor can I (the more I look at it) see how any one who has examined into the matter can think otherwise.

With great respect, I am your obedient servant,

JAMES ALDEN,
Lieut. Comg. U. S. Navy, and Assistant U. S. Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey, Washington, D. C.

PACIFIC MAIL STEAMSHIP PANAMA, *April* 5, 1852.

DEAR SIR: Your communication of the first of March is before me, and, in reply, I beg leave to state that I consider Bonita Point decidedly the best location for the light-house at

the entrance of San Francisco harbor, it being two and a half miles further out than Fort Point, and vessels bound in would generally see the light several hours before the light could be seen on Fort Point, and in foggy weather it would be less likely to be capped than if located on the high land of Fort Point.

Indisposition has prevented me from giving you an earlier reply. The "Panama" will leave this point on the 8th, at four o'clock p. m. If you have any documents to forward to Washington, I will take charge of them, and see that they go by the regular U. S. mail from Panama.

Your obedient servant,

JAMES P. WATKINS,
Commanding Steamer Panama.

Lieut. Comg. JAMES ALDEN, *U. S. Navy, &c., &c.*

APPENDIX No. 52.

Letter of the Superintendent of the Coast Survey to the Secretary of the Treasury, transmitting further information showing that Bonita Point should be selected in preference to Fort Point as the location of a first-class light-house.

COAST SURVEY STATION, NEAR PETERSBURG, VA.,
July 2, 1852.

SIR: I have the honor to enclose further information from Lieut. Comg. James Alden U. S. Navy, assistant U. S. Coast Survey, going to show that Bonita Point should be selected for the first-class light at the entrance to San Francisco bay, and not Fort Point; and agreeing, therefore, with his previous statements, to which I have at different times called the attention of the department.

Yours, respectfully,

A. D. BACHE, *Superintendent.*

Hon. W. L. HODGE,
Acting Secretary of the Treasury.

U. S. SURVEYING STEAMER ACTIVE,
San Francisco, May 31, 1852.

DEAR SIR: In compliance with the request made in yours of the 21st ultimo, I have consulted some of the captains of sailing-vessels in regard to the location of the light at the entrance to this harbor. All those to whom I have spoken on the subject agree with me in the opinion already expressed, and the enclosed paper shows very conclusively how great the mistake would be to place a first-class light on Fort Point. Many more names could have been added had there been time.

Sailing-vessels require a wider range even than steamers, owing to adverse winds, and should have something at an important point like this, which stands well out into the sea, and by which they can mark their position should they happen, in making the land, to fall on either side of it.

With great respect, I am your obedient servant,

JAMES ALDEN,
Lieut. Comg. U. S. Navy, Assistant in Coast Survey.

Prof. A. D. BACHE,
Superintendent U. S. Coast Survey.

STEAMSHIP INDEPENDENCE,
San Francisco, May 27, 1853.

DEAR SIR: Your favor of March 1, requesting my opinion in reference to the proper site for a light-house to indicate the entrance to the harbor of San Francisco, has been received; and I have to state that my opinion has always been in favor of the selection of Bonita Point for that purpose, for the reason that a light-house on that point could be seen from vessels coming from the southward of the point, and would indicate to them its entrance; whereas a light-house on Fort Point could not be seen until well up with the entrance, at which time the principal difficulty would be overcome. At the same time, a light on Bonita Point would be as useful to vessels coming from the westward as though on Fort Point.

I remain, dear sir, your obedient servant,

T. D. LUCAS,
Commanding Steamship Independence.

Lieut. Comg. JAMES ALDEN, *U. S. N.*,
Assistant U. S. Coast Survey.

SAN FRANCISCO, *May* 29, 1852.

DEAR SIR: Your communication of March 1, in reference to the site of a light-house for this harbor, reached me too late for me to answer it as promptly as I wished, in consequence of my having been called upon unexpectedly to take command of the steamship Panama on her late voyage down the coast. Having returned, I now beg leave to state that I am of opinion that the light-house in contemplation should be placed at Bonita Point instead of Fort Point, for the reason that a light on Fort Point cannot be seen until you have opened the entrance to the harbor, and would be of little use to vessels coming from the southward, while a light on Bonita Point can be seen on opening the harbor in any direction.

Yours, respectfully,

ROBERT H. PEARSON,
Commanding Pacific Mail Steamship Oregon.

Lieut. Comg. JAMES ALDEN, *U. S. N.*,
Assistant in Coast Survey.

SAN FRANCISCO, *May* 31, 1852.

SIR: We, the undersigned, ship-masters trading to this port, having been informed that Fort Point has been selected by the government as one of the sites for a light-house, and considering that position not at all adapted to the purpose, particularly as the object of that light is to point out the entrance to the harbor, we would respectfully state the objections to Fort Point which, from experience, we know to exist. They are as follows, viz: Fort Point is too far inside, and cannot be seen by vessels coming from the southward until nearly up with the mouth of the harbor, while Bonita Point stands out in full view. Again: Fort Point is entirely shut out to vessels coming from the north, by Bonita Point.

Bonita Point possesses all the advantages, and none of the disadvantages, of Fort Point. We therefore recommend, most earnestly and decidedly, that the light intended to point out the entrance to this harbor be placed on Bonita Point, and that you will use all your influence in the accomplishment of so desirable an end.

JAMES SAVAGE,
SYLVANUS B. BROWN,
(*And forty others.*)

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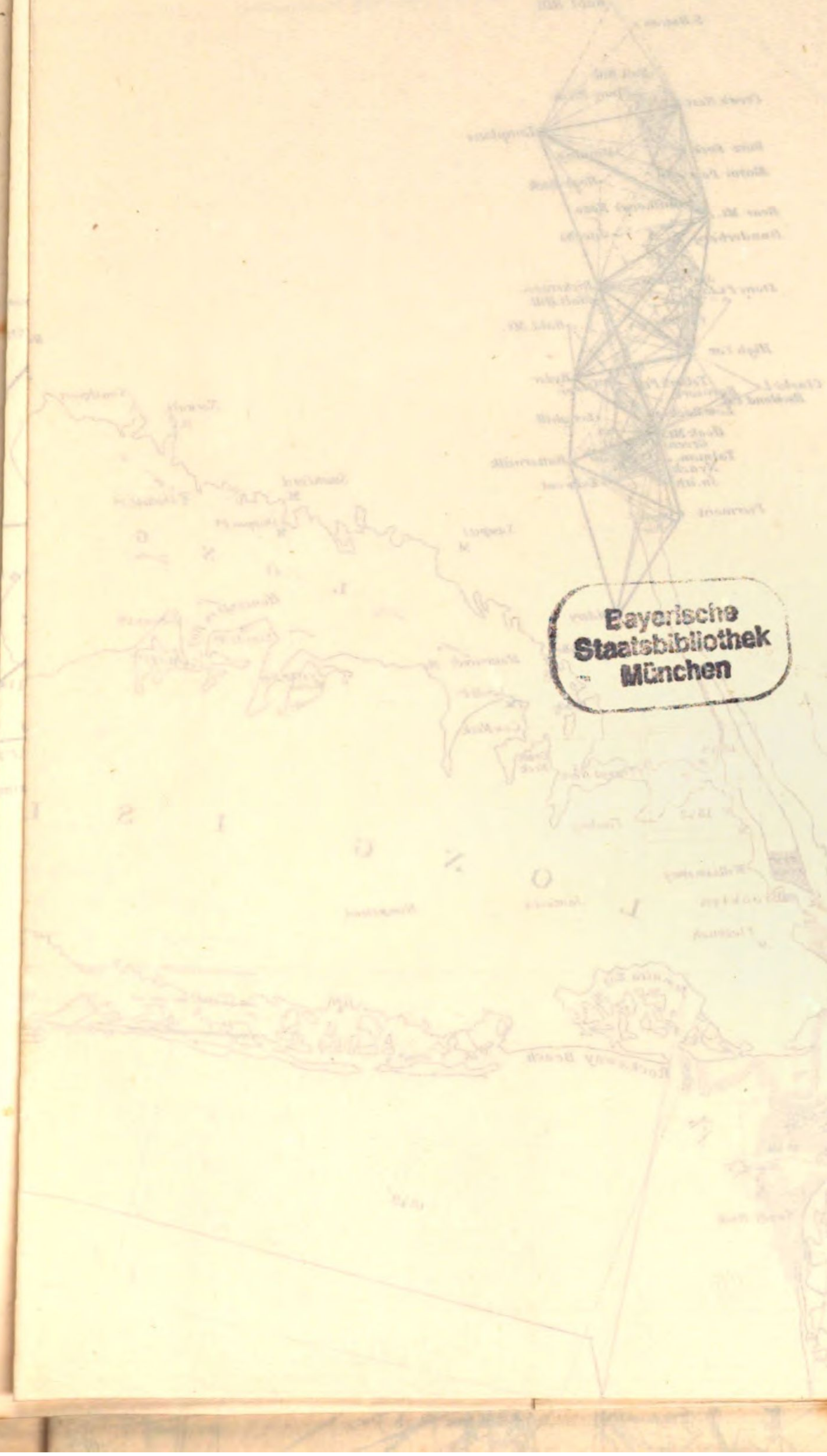

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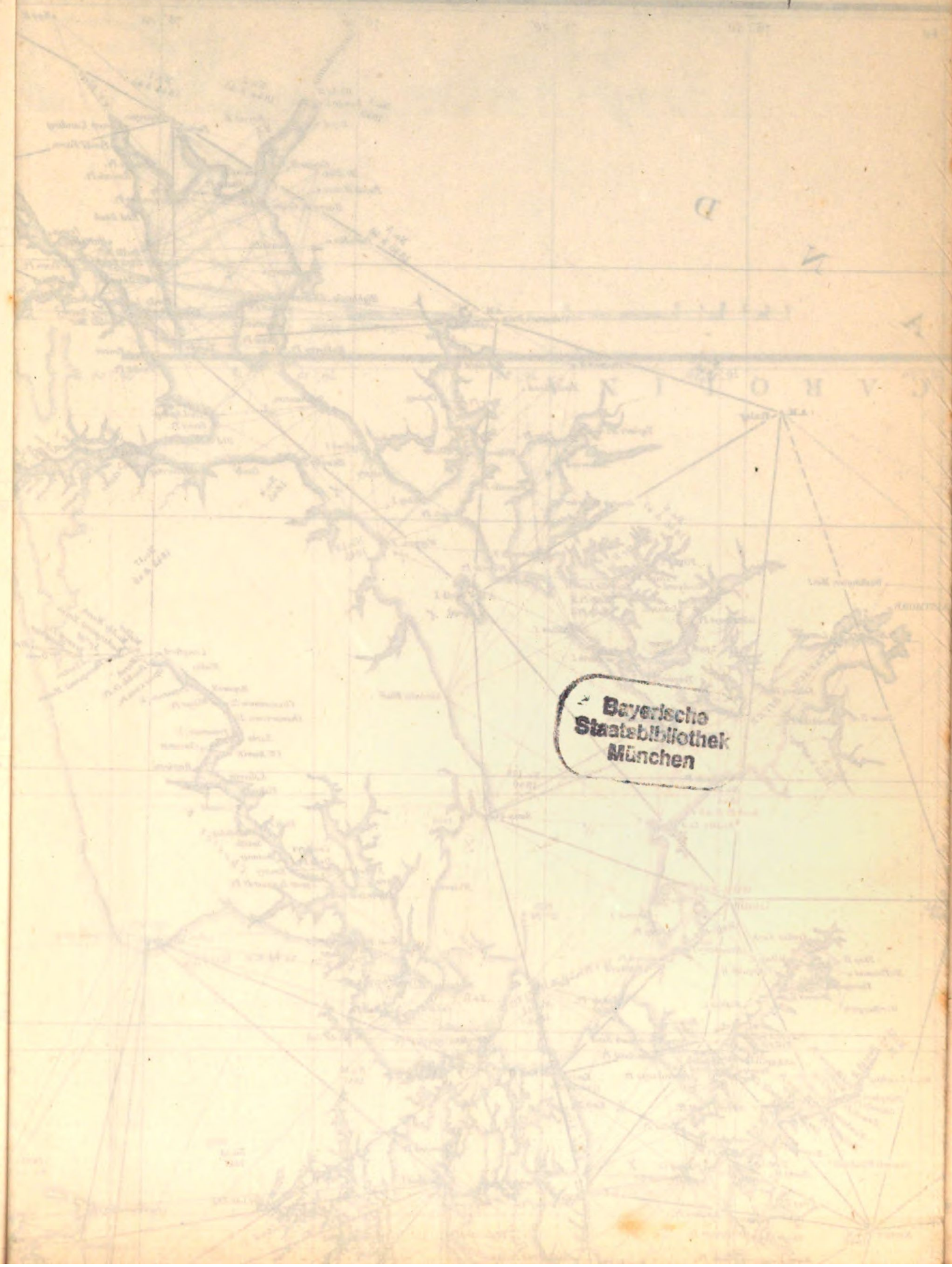

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CAPE FEAR AND VICINITY

1851

The soundings are expressed in feet, and show the depth at mean low water.
The dotted surfaces beyond low water mark represent the bottom at the respective depths of 6, 12, and 18 feet.

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RECONNAISSANCE OF

NEW RIVER AND BAR

NORTH CAROLINA

By the party under the command of

Lieut. J.N. Maffitt U.S.Navy Ass.t U.S.C.S.

In November 1851

Scale 1/80000

1852

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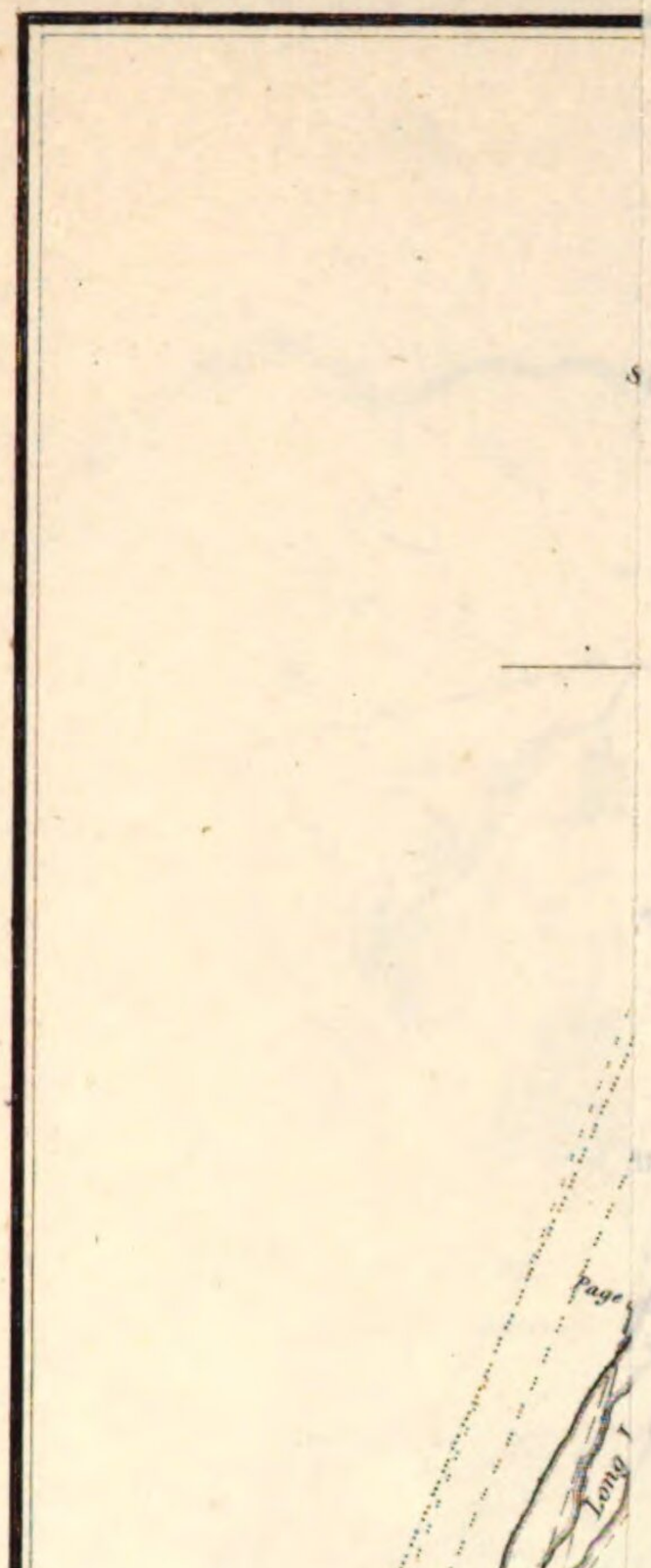

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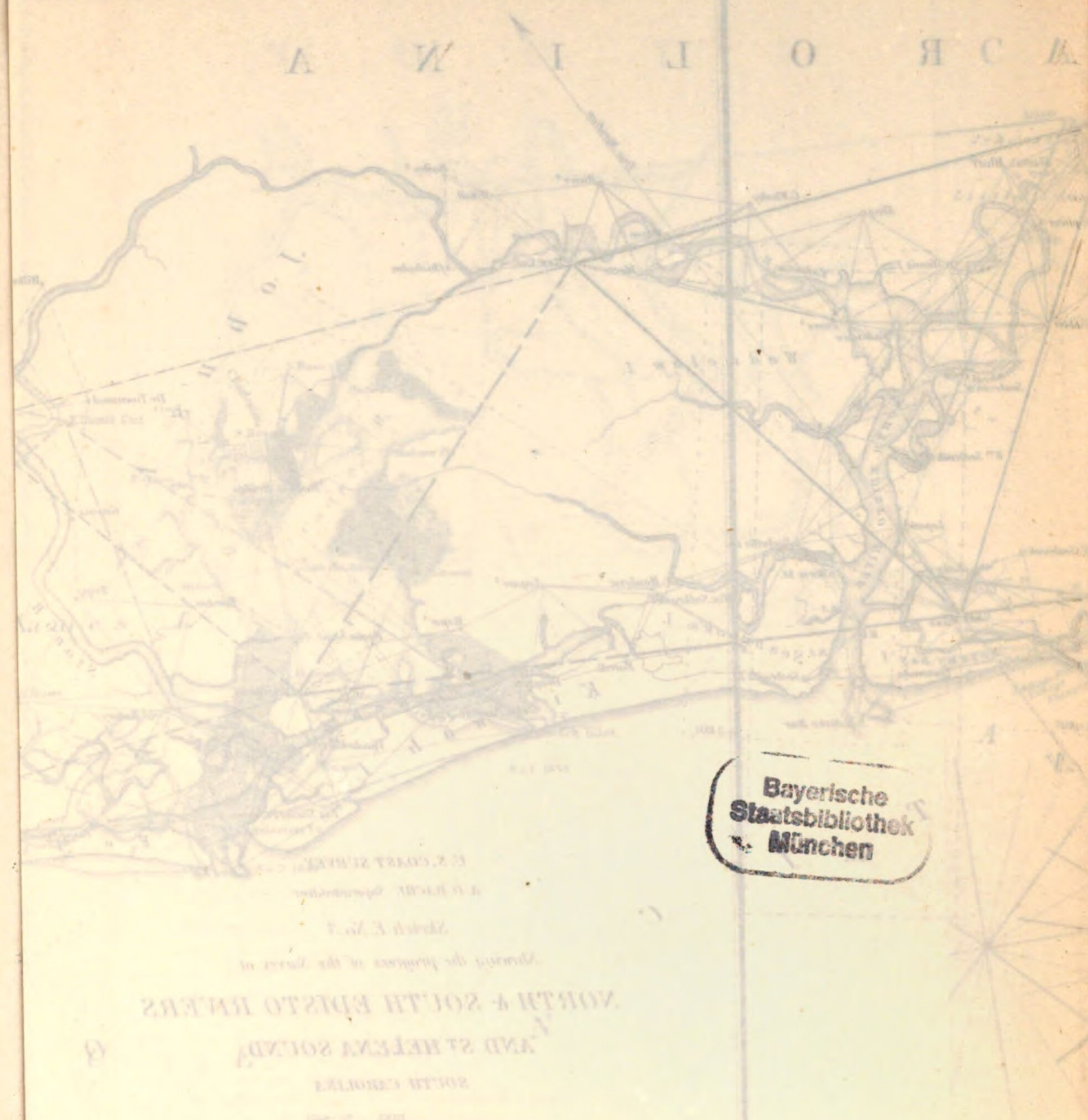

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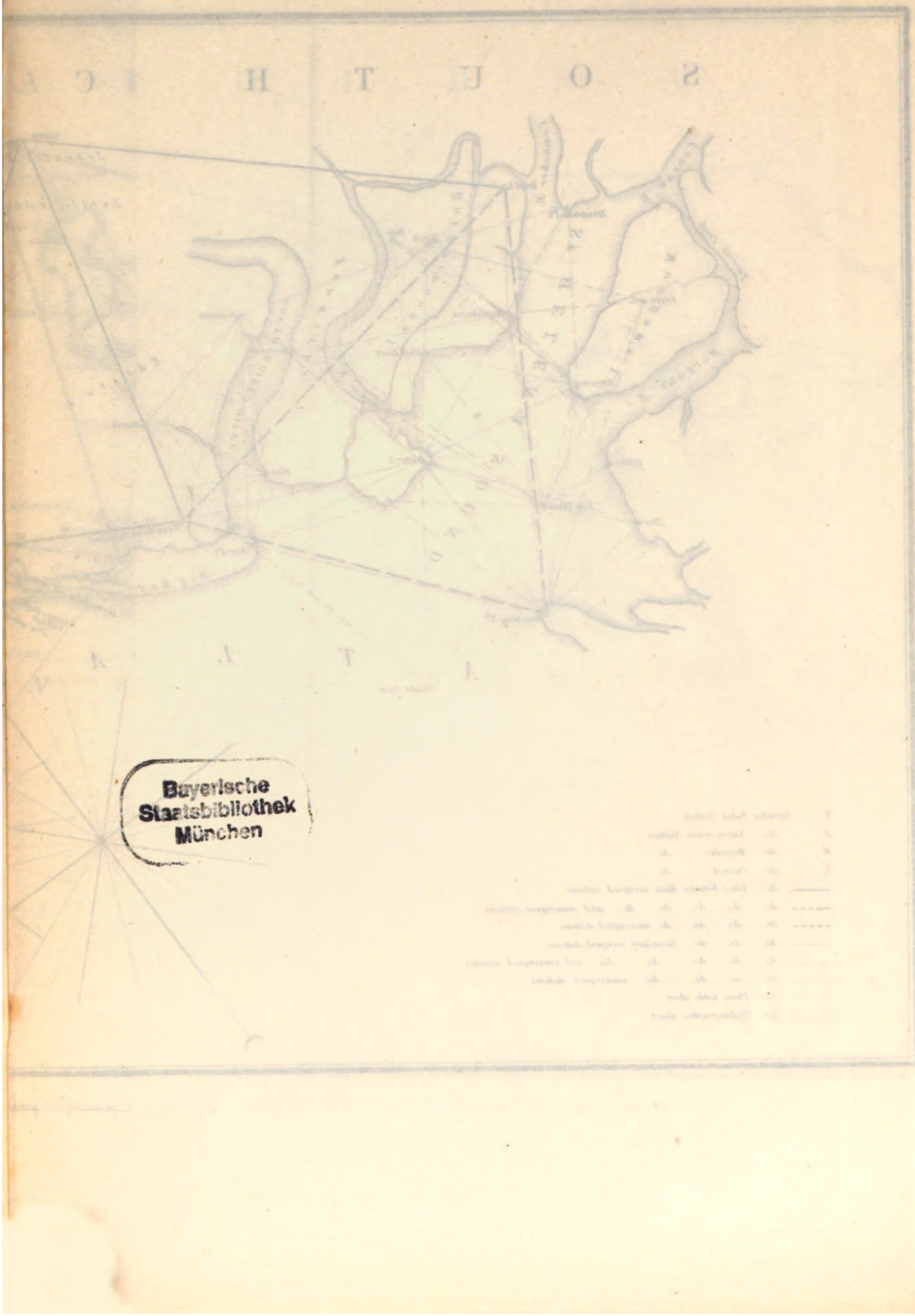

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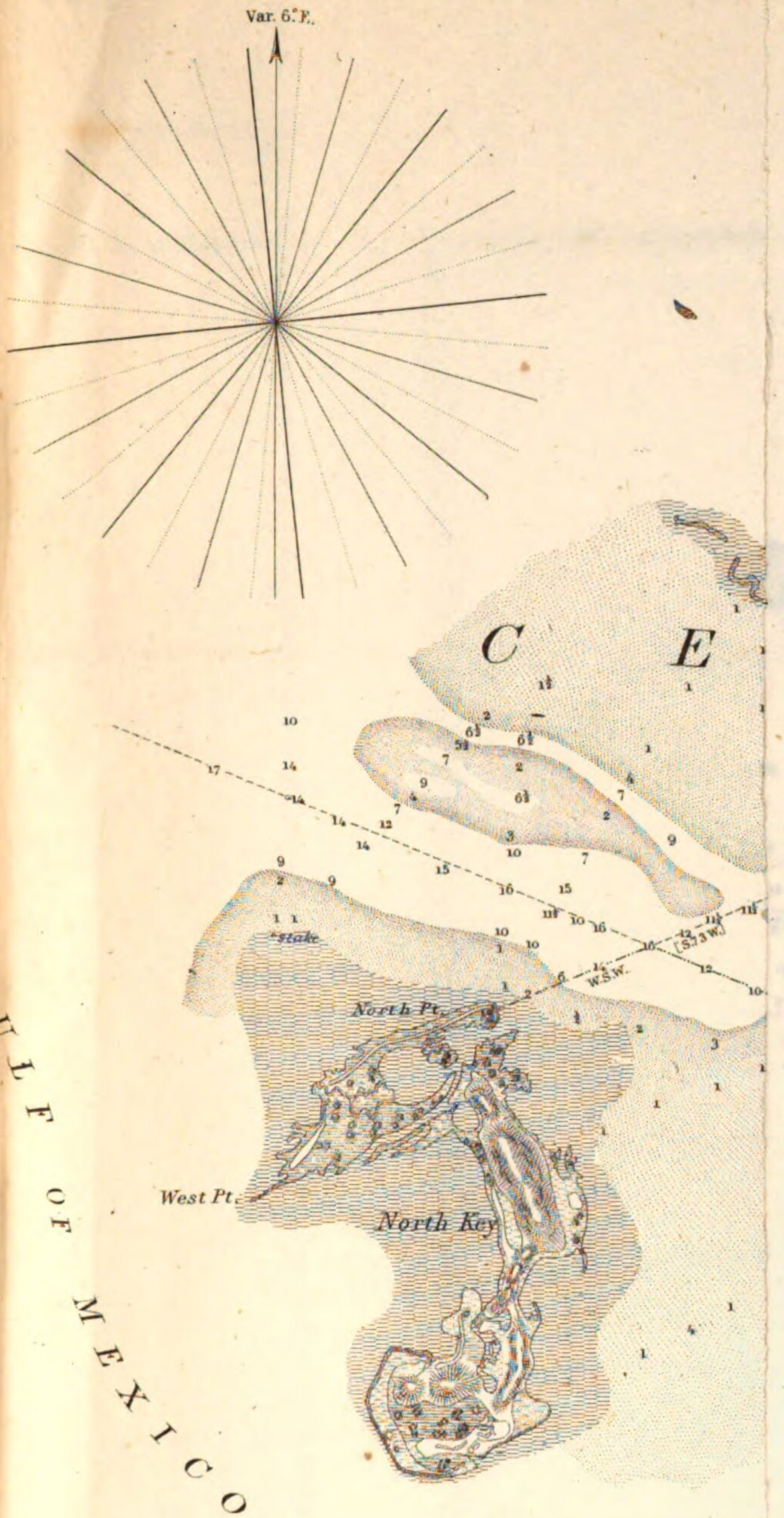

SAILING DIRECTIONS.

Run for North Key, *keeping it on the starboard bow, until the high Mangroves on the North Point of Middle Key bear E.S.E. nearly (S. 62½° E.) in range with the Palmetto Trees on the South Point of Way Key.*

Steer on this course until the North Point of North Key bears W.S.W. (S.73 W.) ranging with the South Point of Key A. then steer E.N.E.(N.73 E.) for Key A. until in 15 feet water, Goose Creek bearing E.¼ S.(S.76 E) then Steer for Goose creek and anchor in 19 feet water.

NOTE.

The Courses and Bearings without the brackets are by Compass, those within are true. The Soundings are expressid in feet and show the depth at mean low water, the plane of reference. The dotted surfaces beyond low water mark represent the bottom within the depth of 6 feet. The characteristic soundings only are given on the sketch. They are selected from the numerous soundings taken in the survey so as to represent the figure of the bottom.

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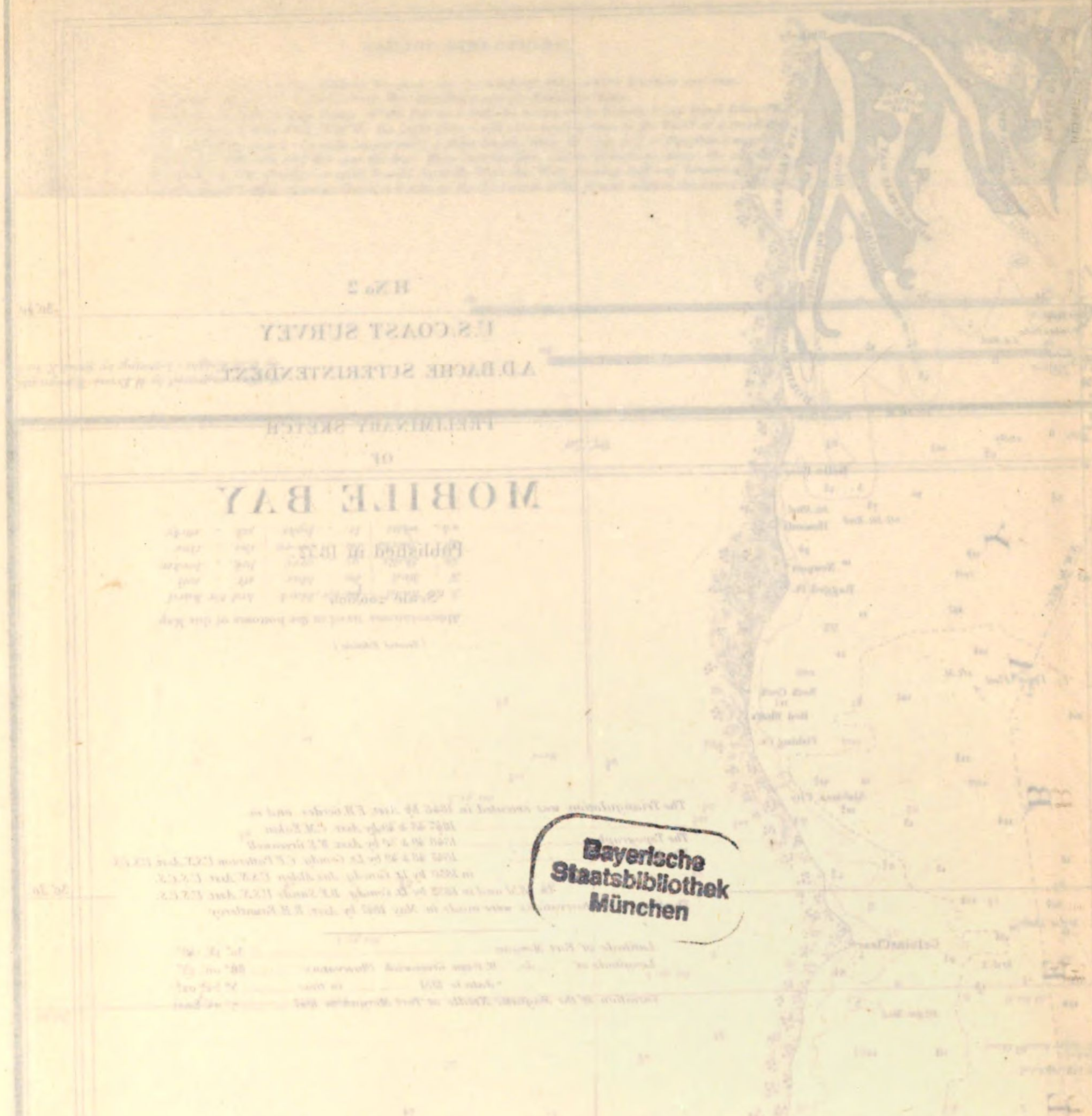

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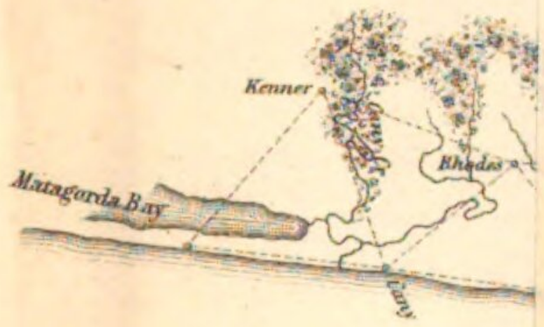

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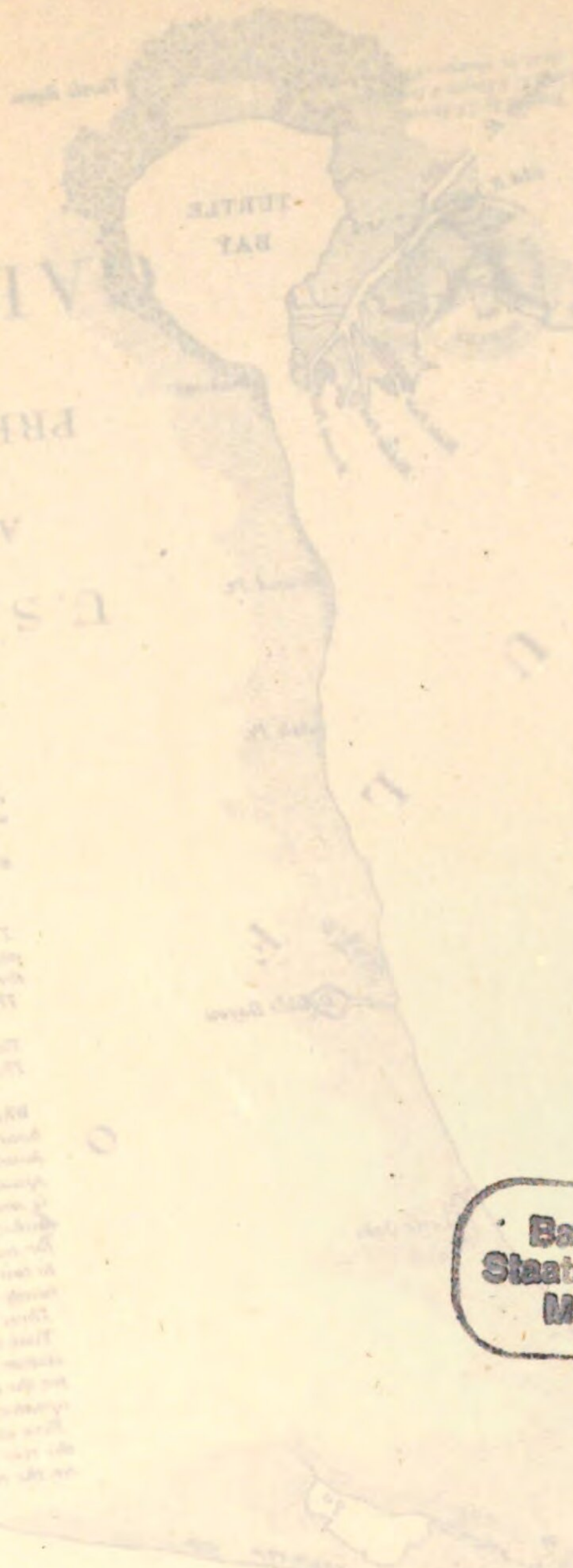

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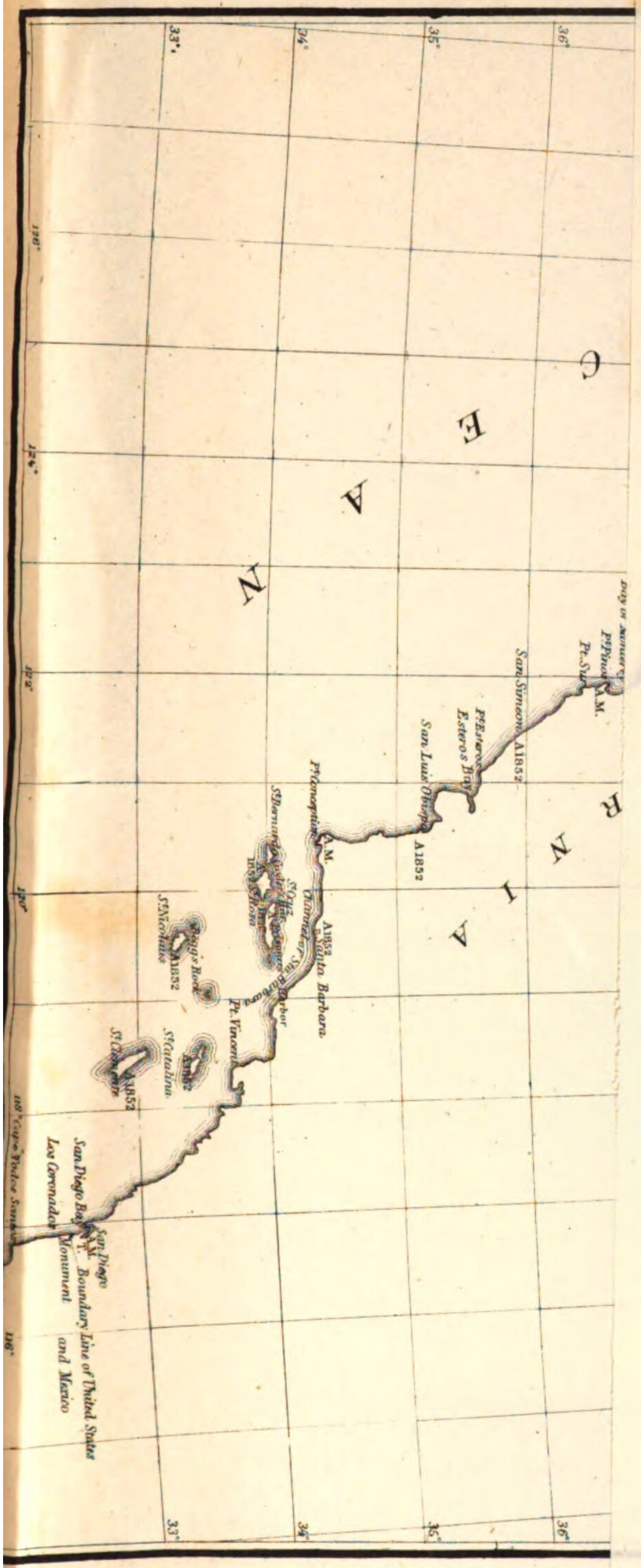

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U. S. COAST SURVE

A.D.BACHE Superintendent

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No. 5

U.S. COAST SURVEY

A.D. Bache Superintendent

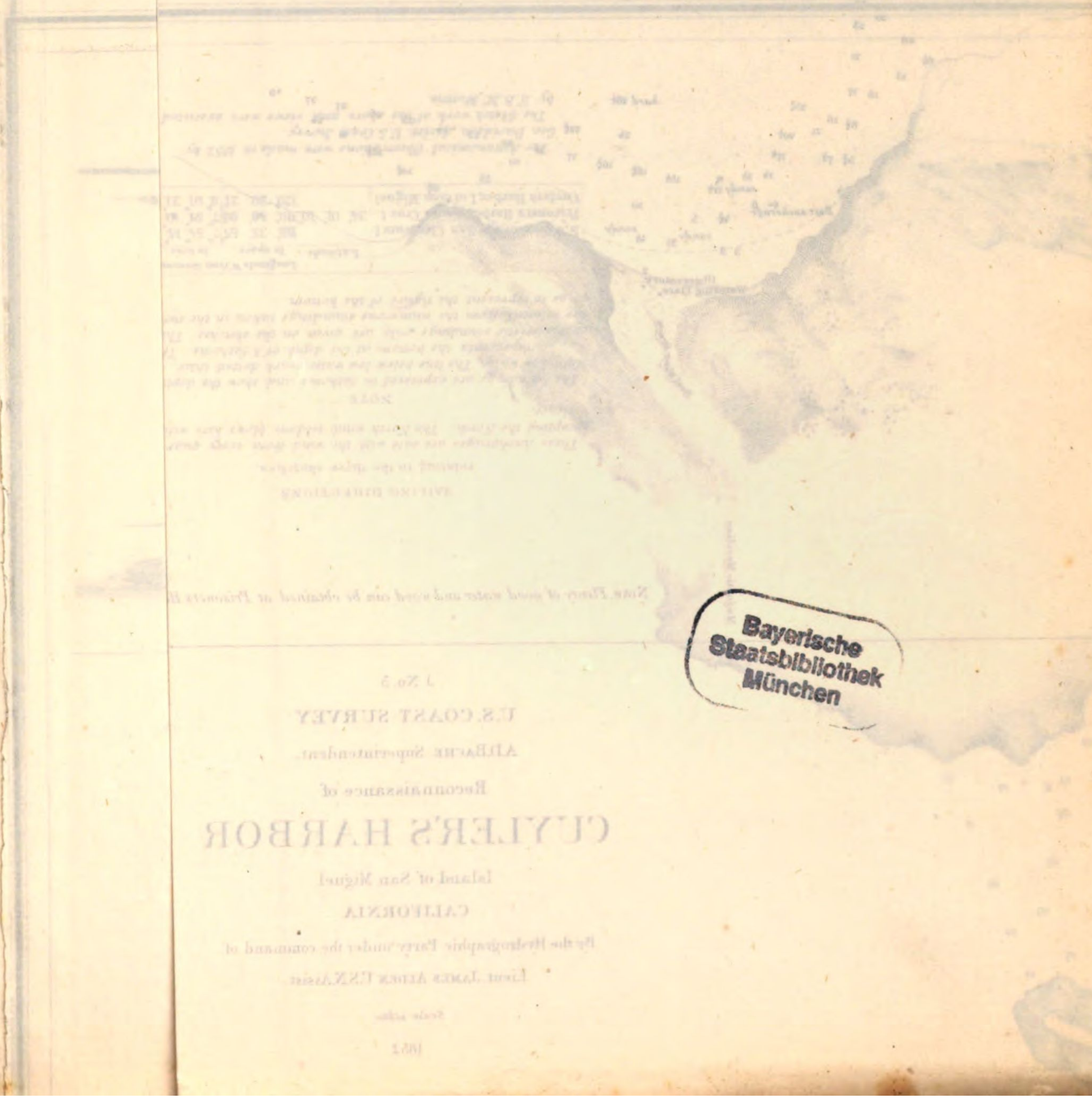
Reconnaissance of

SAN CLEMENTE HARBOR

CALIFORNIA

By the Hydrographic Party under the command of

Lieut. James Alden U.S.N. Assist.



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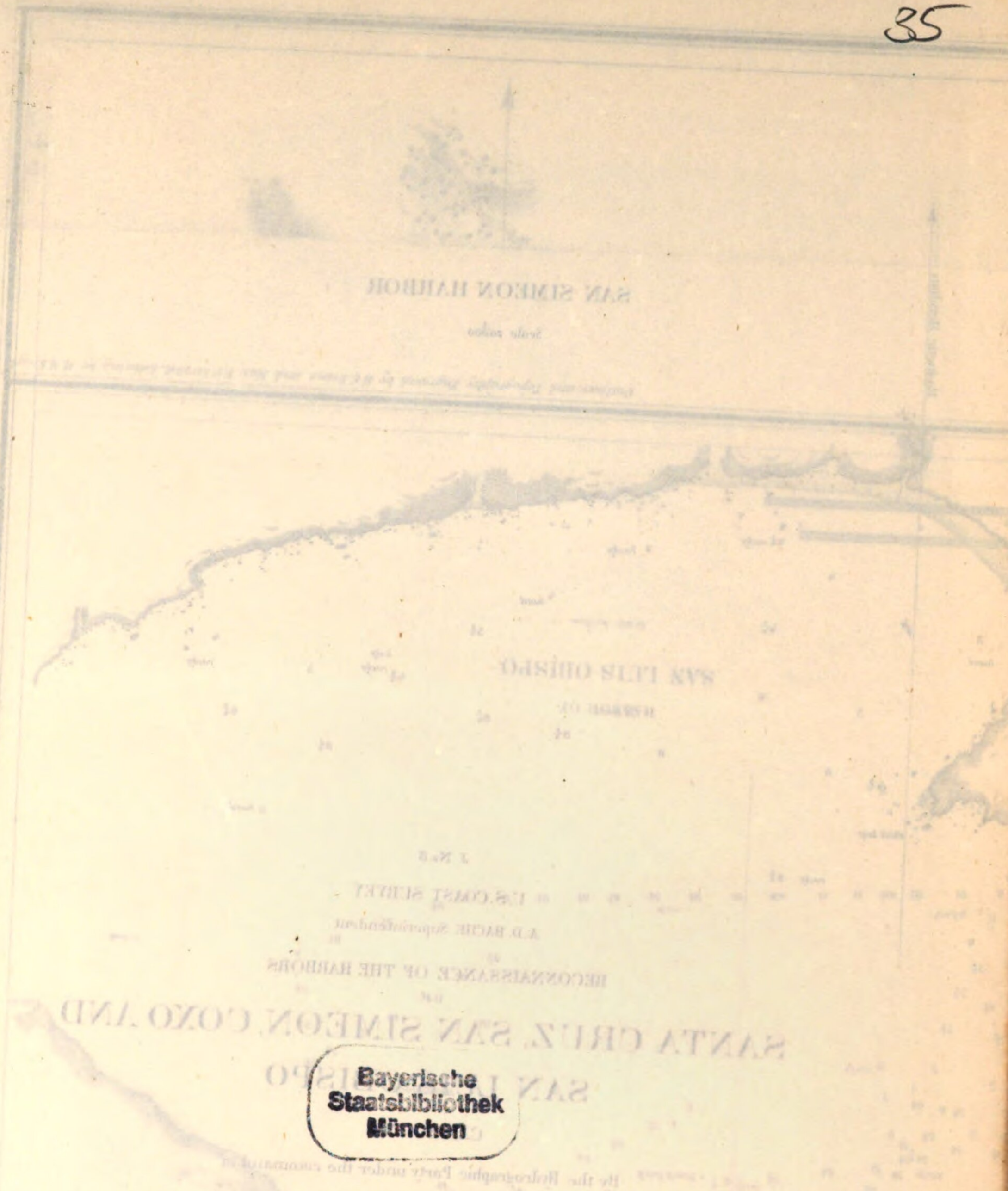

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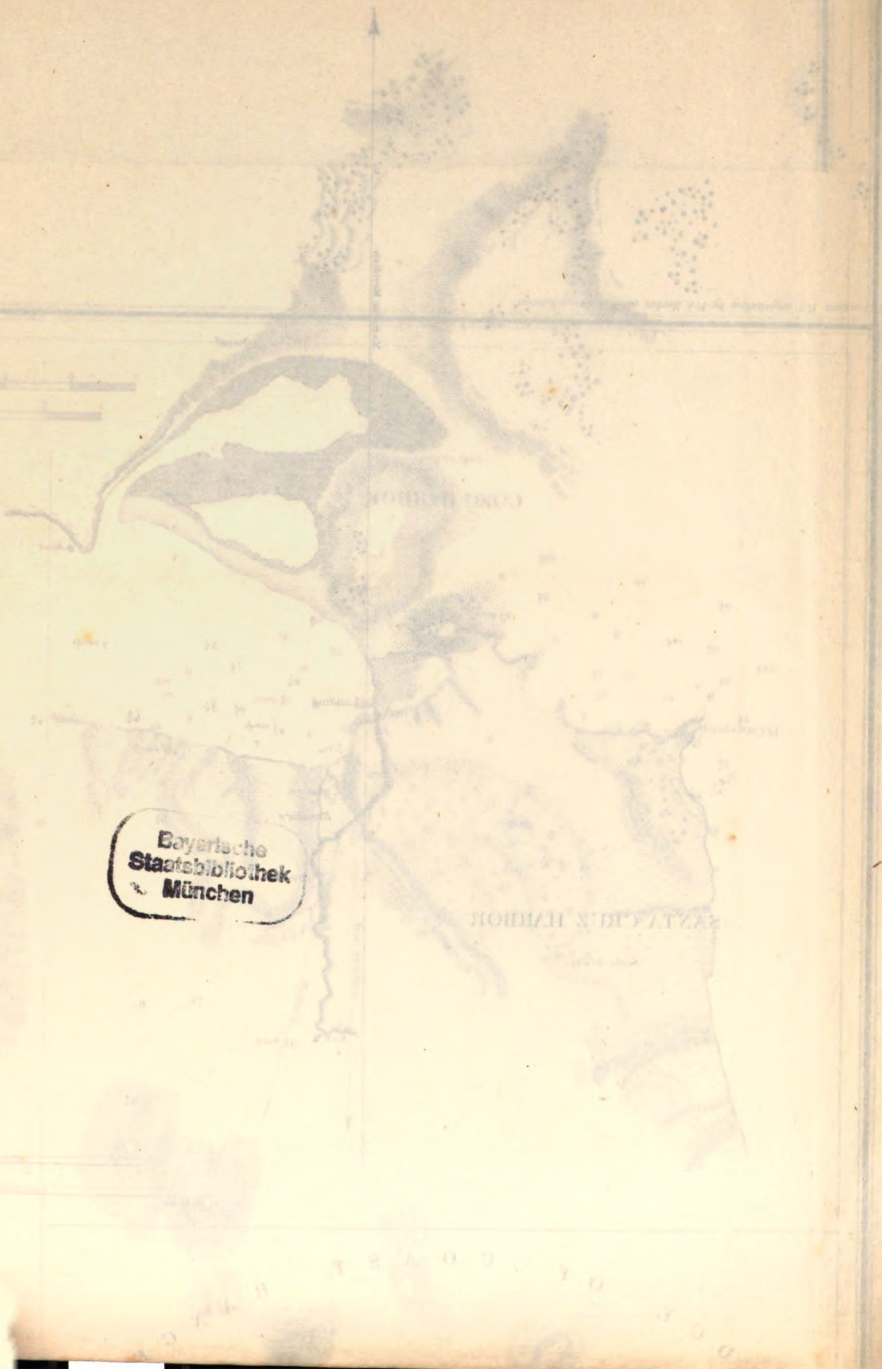

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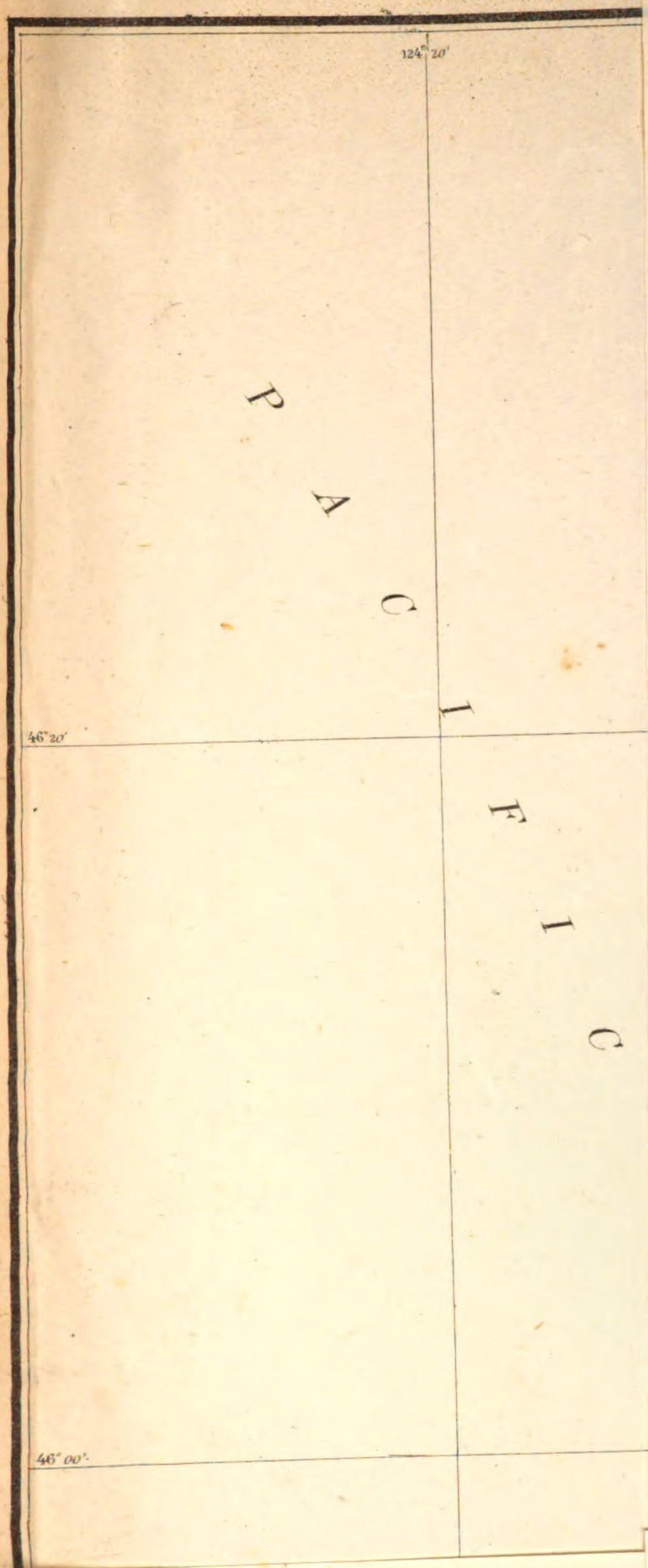

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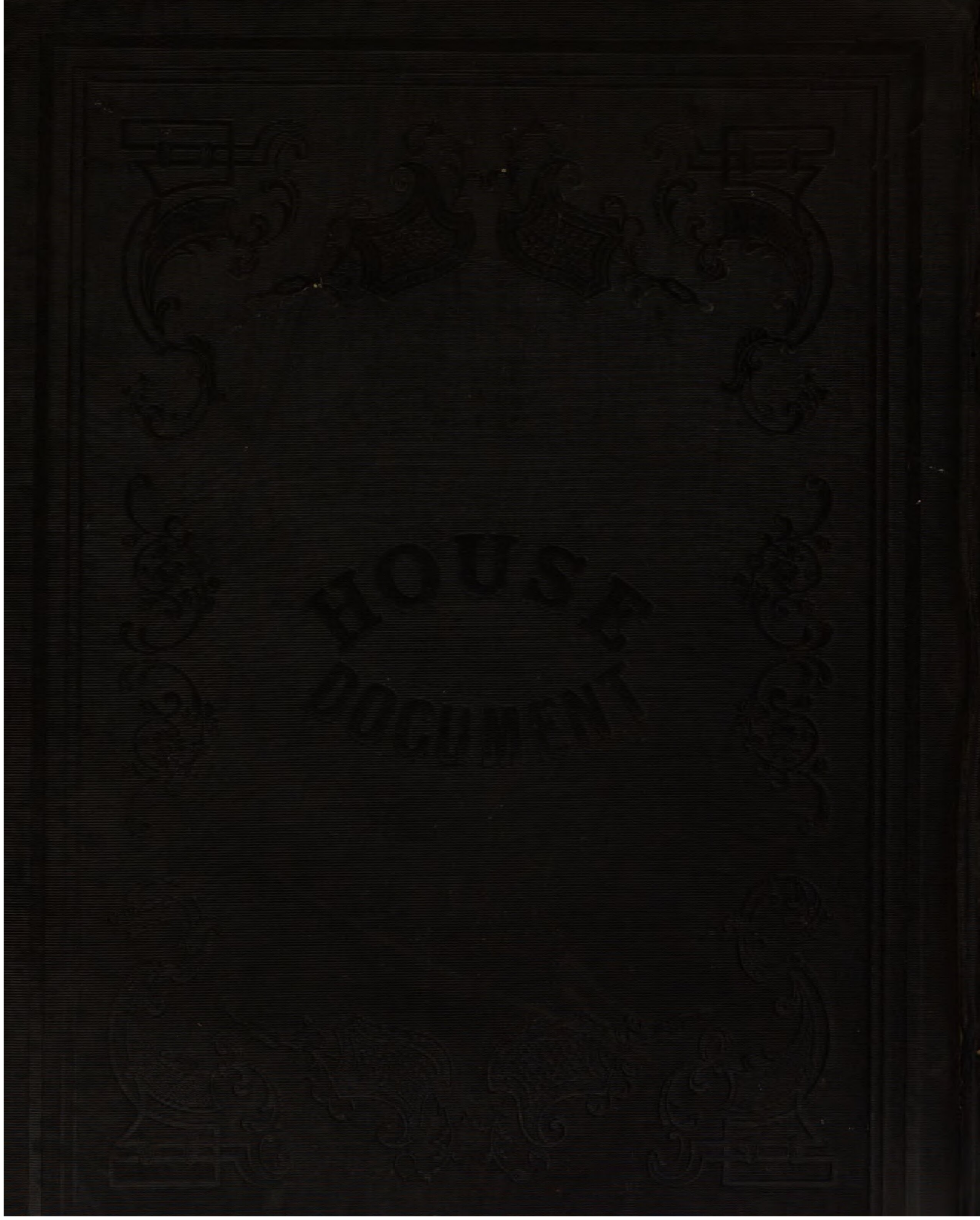

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